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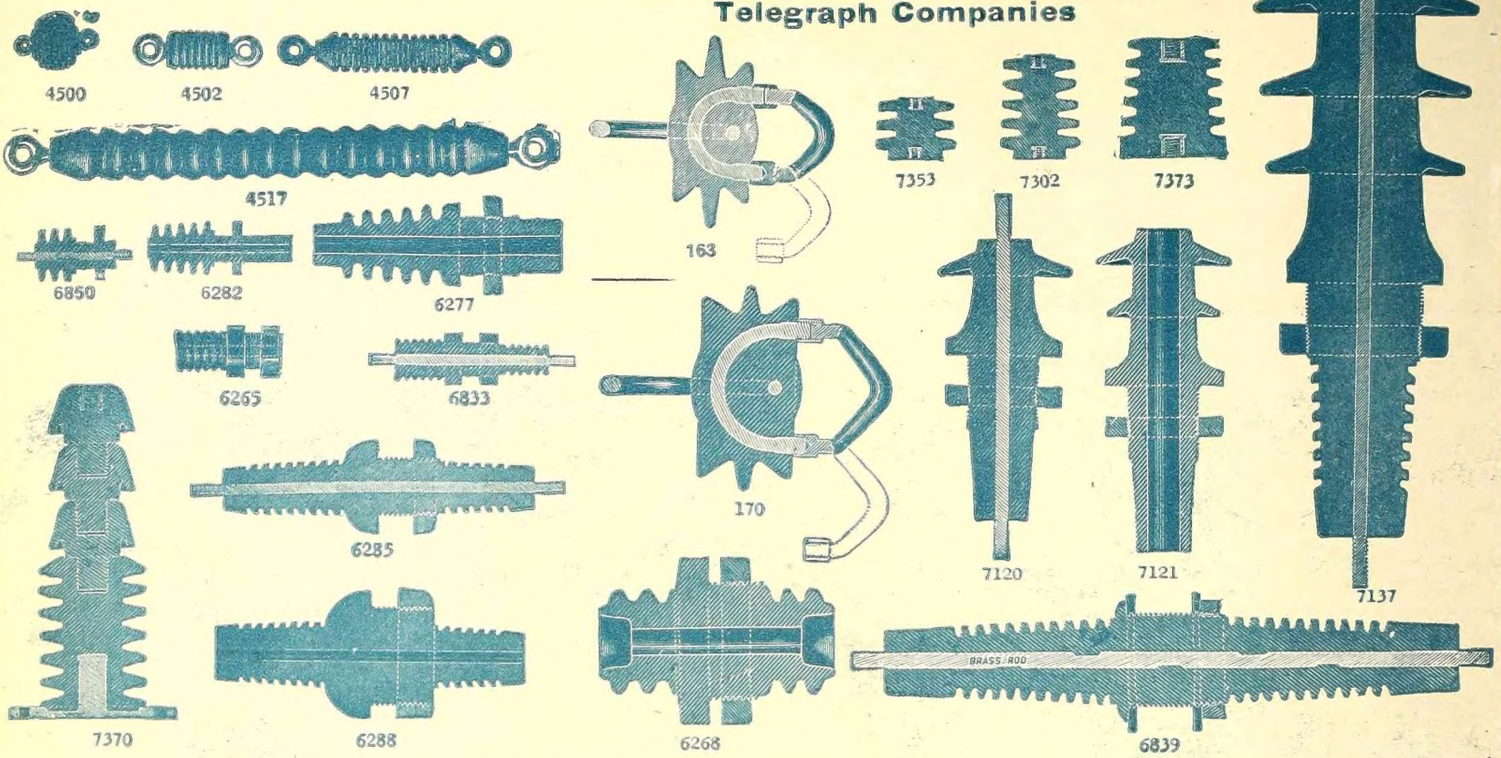


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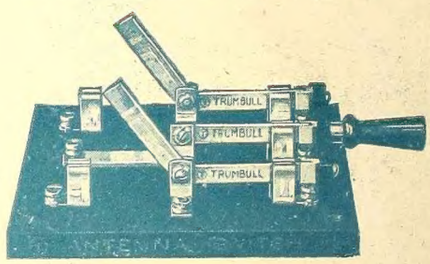


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# The Electrical Experimenter

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## With the Editor

WE believe that you will like this number of *The Electrical Experimenter*. As will be noted, the size has been increased again, from 32 to 48 pages, a 50% increase of text matter. No expense has been spared toward making this issue as perfect as we know how and you will agree with us that it is a big improvement over former numbers.

You will find feature articles in the June number which you cannot find in any other magazine. Our readers have come to know *The Electrical Experimenter* for publishing new and important things electrical, ahead of any other magazine, and we believe that you will agree with us that the manner in which we present the various articles now cannot be much improved upon.

Unquestionably this magazine to-day is the greatest electrical 10c. worth in the country; its 48 large pages represent 96 pages of the ordinary magazine size. The June number with its 123 illustrations and its 109 articles, excels a great many 15c. publications.

Nevertheless, we are far from satisfied; it is our ambition to regularly publish a magazine above 100 pages at 10c. a copy. Will you help us in our task?

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*Second,* if you like this magazine tell your friends about it, or, still better, when you send in the voting blank, write the names of a few friends interested in electricity on the reverse side. We will promptly send them sample copies with our compliments.

The July issue will have some very important articles and you will also find in it some new intensely interesting departments which we know you will welcome.

Beginning with the August issue we have a nice surprise awaiting you; WATCH FOR IT!

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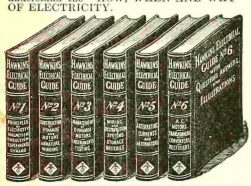


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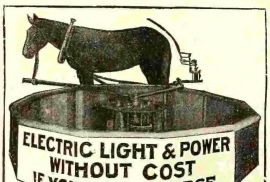


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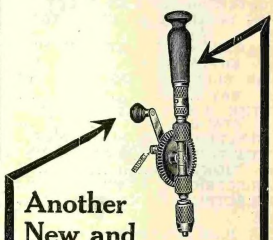

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Vol. III. Whole No. 26 JUNE, 1915 Number 2

## Talking Motion Pictures and Selenium

By Samuel Wein

IN the present-day talking motion picture systems, use is made of simultaneously recording and reproducing animated objects and sounds, by means of combining the motion picture machine and the phonograph. The success attained thereby is of very little practical importance, owing to the difficulty of ensuring perfect synchronism. Another method recently patented was to record the sound waves from the needle of the phonographic "sound box" on the same film with the motion pictures; the success attained in this method is of no value at all on account of the fact that duplicates were impossible to make and not only that, but that the film in order to reproduce the sounds therefrom must be a little thicker than what it is; otherwise the sounds will not be reproduced successfully.

It is essential to the correct reproduction of the movements of the persons or objects in combination with the sound waves, that the simultaneous movements and sounds should be recorded and reproduced simultaneously in exact synchronism and that the sound waves which constitute the sounds should not suffer any variation in the process of recording and reproduction, but should be recorded and reproduced without the introduction or accompaniment of any other sound waves.

It is obvious, therefore, that no true record or reproduction of the sound waves could be made by any mechanical process or means in which a hard substance necessary to make the impression comes in contact with another hard substance, such for instance as the recording or reproducing pin of the phonograph, because the friction caused between the two hard substances itself creates vibration or sound waves which accompany, vary or modify, the sound waves which it is desired to record and reproduce. These are recorded and reproduced with the latter, proving detrimental to their true acoustic reproduction. The record, therefore, must be taken or produced without any contact between the medium caused to vibrate by the sound waves and the record or recording substance. It is further obvious that if the impressions of the movements and sounds were recorded separately on separate records, the movements and sounds would be liable to vary in point of time and fail to synchronize with each other.

Another disadvantage of the present day talking motion picture machines or systems is that if the operator either neglectfully or wilfully tears or cuts out a piece of the film which constitutes the movements or actions, the result would be that a certain amount of action or movement is missing, but, the equivalent in sounds would still be in the phonographic record, thus showing the device would soon be put out of synchronism at this point.

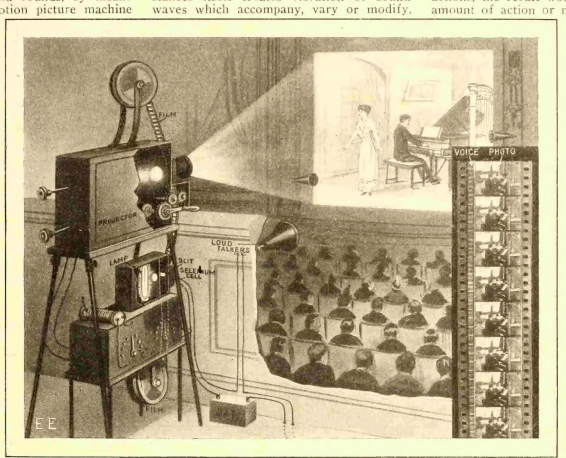


Fig. 2. How the Voice and Picture, Photographed on the Same Film, Are Projected in the Theater. At Right: Strip of Double Record Film.

In order to avoid this and to insure correct synchronism the late Dr. Ernest Ruhmer of Germany (see *Scientific American*, July 20, 1901) already in 1901, in his experiments with the "photographophone," was the first to suggest that the "movements and sounds must be recorded (photographically) simultaneously, on the same photographic film."

For the purpose of collecting or receiving the sound waves, a sensitive telephone transmitter is employed to transmit the sound waves electrically (in the usual manner) from the place where the sounds originate to the motion picture camera; which has a source of light so arranged that it will vary in degrees as to area, quantity, intensity and corresponding effect of light and shade, proportioned to their period and amplitude, simultaneously with the recording photographically of the successive movements of the objects on the same film, as outlined in Fig. 1. Fig. 2 shows voice waves thus photographed on the strip of film alongside of the picture space.

When such a film record is obtained, it is reproduced by causing light to pass through that portion of the film contain-

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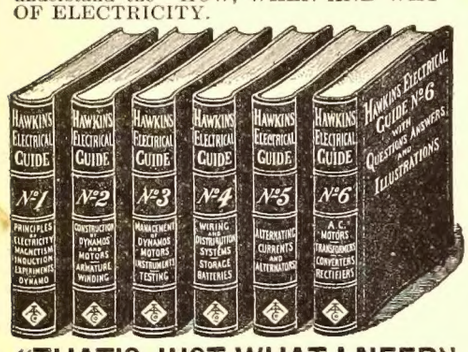


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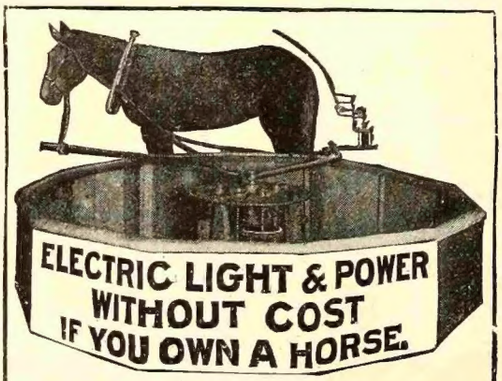


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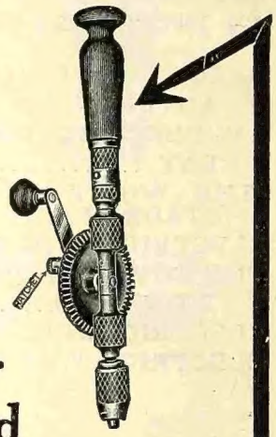

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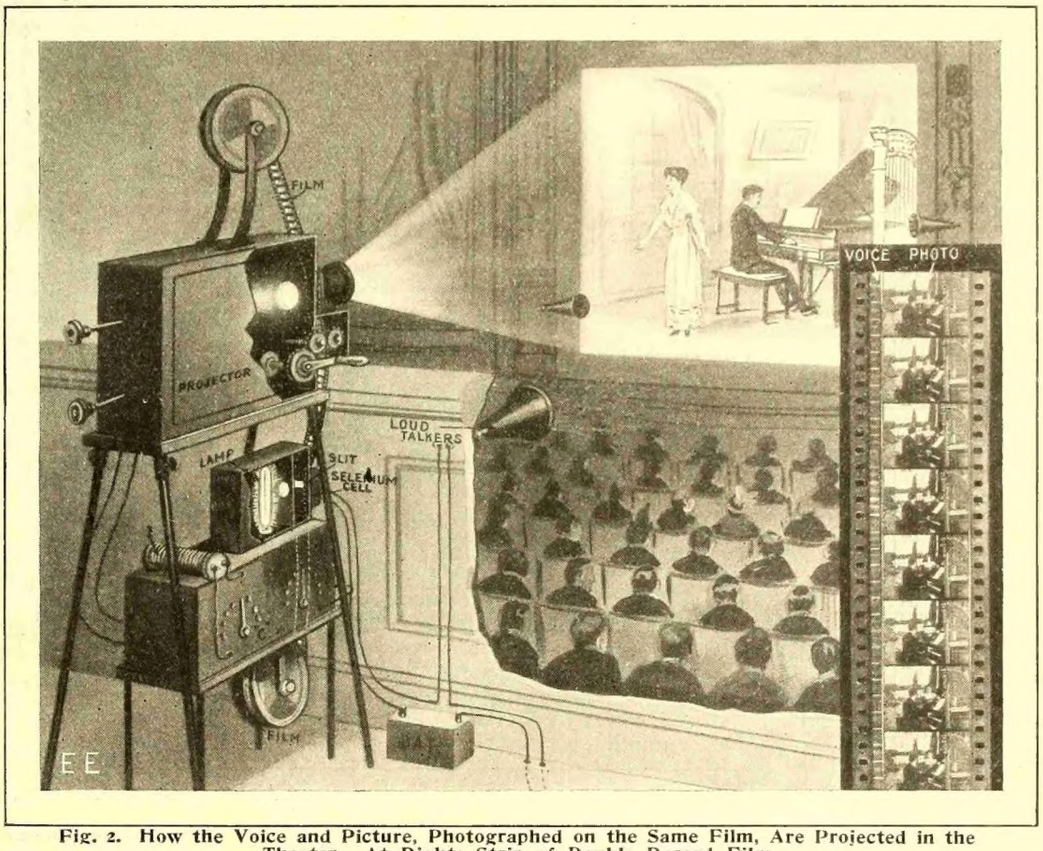


Fig. 2. How the Voice and Picture, Photographed on the Same Film, Are Projected in the Theater. At Right: Strip of Double Record Film.

It is essential to the correct reproduction of the movements of the persons or objects in combination with the sound waves, that the simultaneous movements and sounds should be recorded and reproduced simultaneously in exact synchronism and that the sound waves which constitute the sounds should not suffer any variation in the process of recording and reproduction, but should be recorded and reproduced without the introduction or accompaniment of any other sound waves.

It is obvious, therefore, that no true record or reproduction of the sound waves could be made by any mechanical process or means in which a hard substance necessary to make the impression comes in contact with another hard substance, such for instance as the recording or reproducing pin of the phonograph, because the friction caused between the two hard substances itself creates vibration or sound waves which accompany, vary or modify, the sound waves which it is desired to record and reproduce. These are recorded and reproduced with the latter, proving detrimental to their true acoustic reproduction. The record, therefore, must be taken or produced without any contact between the medium caused to vibrate by the sound waves and the record or recording substance. It is further obvious that if the impressions of the movements and sounds were recorded separately on separate records, the movements and sounds would be liable to vary in point of time and fail to synchronize with each other.

Another disadvantage of the present day talking motion picture machines or systems is that if the operator either neglectfully or wilfully tears or cuts out a piece of the film which constitutes the movements or actions, the result would be that a certain amount of action or movement is missing, but, the equivalent in sounds would still be in the phonographic record, thus showing the device would soon be put out of synchronism at this point.

In order to avoid this and to insure correct synchronism the late Dr. Ernest Ruhmer of Germany (see *Scientific American*, July 20, 1901) already in 1901, in his experiments with the "photographophone," was the first to suggest that the "movements and sounds must be recorded (photographically) simultaneously, on the same photographic film."

For the purpose of collecting or receiving the sound waves, a sensitive telephone transmitter is employed to transmit the sound waves electrically (in the usual manner) from the place where the sounds originate to the motion picture camera; which has a source of light so arranged that it will vary in degrees as to area, quantity, intensity and corresponding effect of light and shade, proportioned to their period and amplitude, simultaneously with the recording photographically of the successive movements of the objects on the same film, as outlined in Fig. 1. Fig. 2 shows voice waves thus photographed on the strip of film alongside of the picture space.

When such a film record is obtained, it is reproduced by causing light to pass through that portion of the film contain-

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ing the picture record of the successive movements, and so project them on to a screen, and also simultaneously cause light to pass through that portion of the film,

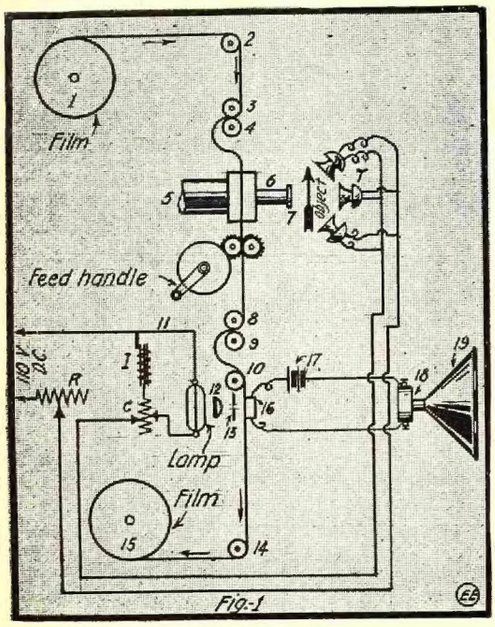



**Fig. 1. Schematic Layout of Talking Picture Arrangement.**

containing the *photographic sound record,* and thence onto a selenium cell, which is connected in series with a battery and a loud speaking telephone receiver.

In the diagram of this whole arrangement, fig. 1, the film unwinds down through the lense barrel and intermittent feed mechanism 5, 6, 7, idlers 3, 4, 8 etc., and also through the sound registering parts 11, 12, 13 etc. When the moving subject is photographed before the lense 7, the accompanying sounds as voices, music, et cetera, are picked up by a battery of microphones "T," and transmitted electrically over the circuit to a lamp circuit 11. This lamp is a straight filament "Radox" or "Line-o-lite" bulb, subject to voice control by the microphone "T" variations in resistance; R is a resistance, I an inductance and C a choke coil.

Every changing sound causes the microphones T, to affect the brilliancy of the "Radox" lamp. These light variations representing the voice are photographed through a small slit in a screen 13 on to the moving film. The film must pass steadily by this slit and not with an intermittent

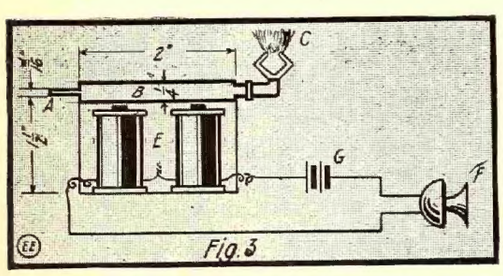



**Fig. 3. Showing How the Voice Can Control Gas Flame.**

motion, suitable propelling devices being used, of course.

After the sound is recorded the film is developed, fixed, and a print is made in the usual manner. It is then placed in a projecting machine with a selenium cell placed as shown at 16, connected in series with a source of current 17, and a loud speaking telephone receiver 18. The steady light from a lamp is thrown against the film through slit 13, and the voice wave bands of light and dark tones cause varying degrees of light to reach the selenium cell 16. Hence the cell has a constantly changing resistance, which is electrically communicated to the loud talkers 18, placed around the theater.

This loud-speaking telephone receiver is built on a new principle employing compressed air.

The usual method of recording photographically the voice on a moving film or plate is by means of a manometric capsule flame. This is arranged as per fig. 3, where an acetylene gas column in chamber B, is caused to vibrate by the varying electric current passing through the magnet coils E, controlled by a microphone F and battery G. This system has considerable promise for the future and opens up a wonderful field for experimenters.

---

For the last month radio amateurs and experimenters about New York have been greatly puzzled when listening to the powerful signals flashed off and on, the pitch of them being quite out of the ordinary. These signals are transmitted by the new Marconi Wireless Telephone at Wanamaker's, New York.

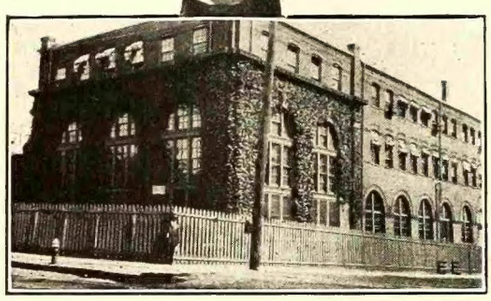
## THE EDISON LABORATORY AND THE BRAINS BEHIND IT.

One can hardly imagine the great variety of wonderful inventions that have been developed in this small red brick building partly covered with creeping ivy. Thomas A. Edison, "prince of wizards," has spent many years and fabulous sums of money in perfecting his hundreds of inventions, some of which are more or less familiar to all of us.

The photograph herewith shows a recent likeness of Mr. Edison and his large laboratory situated at West Orange, N. J. Behind the large front windows is the wonderful library. It is in this library where Mr. Edison is encircled by thousands of books of every conceivable nature when looking up data for experiments.

Various departments are distributed throughout the laboratory building, such as the chemical department, where thousands of chemical reactions are critically studied; also the electrical, mechanical and research departments. It is in the latter department where Mr. Edison himself keeps continually busy. Every facility is afforded for thorough research in any branch of electrical engineering, and a staff of technical

**"Prince of Electrical Wizards," Thomas A. Edison.**



**Below: The Wonderful Edison Laboratory at East Orange, N. J.**

experts are kept busy at all times, delving into the never-ceasing wonders of Dame Nature's secrets, under the guidance of the master mind.

## THE ELECTRO MAGNET, PAST AND PRESENT.

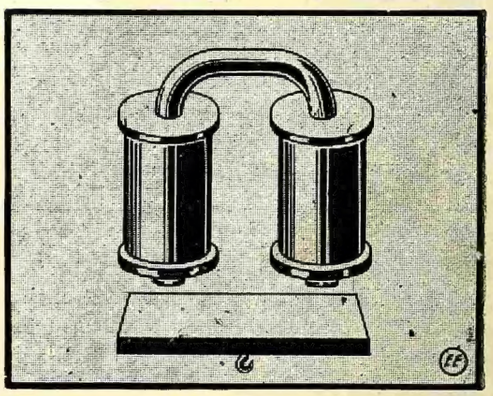
It is now 95 years since the discovery of the magnetic field which surrounds a

**Modern Type Electro-Magnet Lifting Pig Iron from Freight Car.**

conductor carrying an electric current. This was discovered in 1820 by Oersted, of Copenhagen, Denmark. We are herewith presenting an illustration of the first small electro-magnet, which was made by Faraday. Such electro-magnets were difficult to make, of course, in the early days, as the copper wire had to be insulated by hand or else specially made up in a hand spinning device. The other photograph shows the latest lifting magnet which is widely used by large iron foundries for transporting pig iron from one place to another, unloading freight cars and the like.

Powerful electro-magnets are often utilized in lifting submerged iron bodies, such as parts of machinery, barrels of nails, etc., lost in steamer wrecks.

The present electric lighting system depends entirely upon the electro-magnets in the electro-dynamic machine, driven, of course, by a prime mover, such as a steam engine, etc. Practically the entire elec-



**Early Type of Electro-Magnet Such as Used by Faraday.**

trical industry is based upon Oersted's epoch-making discovery.

---

One should always speak of the electro-motive-force (E. M. F.) between two points; never of the E. M. F. in a circuit, except when one is speaking of an induced E. M. F. or voltage.

# The Rôle of Electricity in Film Plays

**By H. Winfield Secor**

PHOTO-PLAYS of modern vintage are at last realizing the wonderful possibilities of scientific accomplishments, such as "wireless," in making their stories of more than ordinary or passing interest. Notably are these scientific facts utilized in weaving the story and portrayal of Pathé Brothers' *The Exploits of Elaine* and the Universal feature film play, *The Black Box*. These films are perhaps more highly scientific in a popular way than anything produced heretofore.

That thousands of dollars should have been invested in producing them brings to mind the trite old adage that "truth is stranger than fiction." This has been proven so time and again, but never more forcibly perhaps than in the film stories that we are now favored with, particularly those above mentioned.

We show herewith several illustrations of the more interesting critical moments from these two film masterpieces. At Fig. 1 is seen one of the greatest electrical devices ever perfected in use. It is the "electrical resuscitator," invented by Dr. Le Duc, of the Nantes Ecole de Medicine, France, and which machine actually brought a girl back to life recently out on the Pacific Coast after physicians had said that she had been dead for half an hour. Arnold Daly, "the scientific detective," is shown manipulating the switchboard, while the patient is "Elaine" in the person of Miss Pearl White.

In the photo at Fig. 2 the "scientific detective" is again seen (wearing a beard), and here the marvelous Poulsen telegraphone, the electrical instrument that records speech on a tiny moving steel wire, is being connected to the rear of a telephone switchboard. The detective and his assistant then leave the telegraphone installed for a few hours, the telephone conversation between the conspirators meanwhile being faithfully recorded by the instrument. Afterward the instrument and its important message are removed and in his laboratory "Craig Kennedy" reproduces the voice record and at once gleans the conspirators' intentions.

Many more wonderful electrical devices are incorporated in *The Exploits of Elaine*. One of these little known devices is the selenium cell, which changes its electrical resistance when exposed to light. The strip of film reproduced at Fig. 2A shows the well-known E. I. Co. selenium cell with polarized relay, bell and battery used in the Pathé feature film. The flash of a pistol in the conspirator's house lowers the resistance of the selenium cell on the lapel of "Craig Kennedy's" coat, and transmits its signal over a wire passing through a window to the police who are waiting to raid the conspirators.

Turning to the newer film release called *The Black Box*, it may be said that here many of the scientific possibilities not just yet perfected for our every-day use are portrayed in the mysterious tale it depicts so perfectly on the screen. At Fig. 3 the leading characters are observed receiving a wireless message by the ever-changing short and long sparks on the front of the switchboard. Of course, this is somewhat fantastic, as wireless signals are extremely small currents and invariably interpreted through the medium of a set of sensitive telephone receivers. However, to lend more charm and life to the film story, the sparks "coming in" are undoubtedly much more efficacious in their effect on the lay audience.

The important moment depicted in Fig. 4 embodies the ultra-scientific achievement of "seeing over a wire" as yet to be perfected, but which has experimentally been verified on a small scale by Herr Ruhmer, of Germany, and others. The picture materialized or reproduced from a distance over an electrical wire appears on the rapidly rotating disc, seen on the front of the switchboard at the left of the photograph.

Truly, the "movies" are becoming more educational every day.

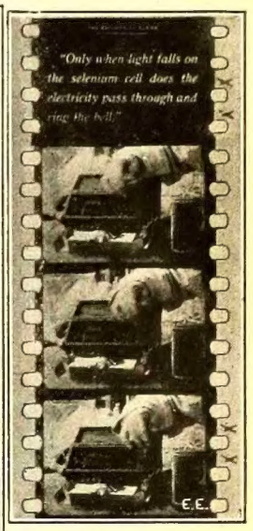



**Fig. 2A. Above: The Selenium Cell Outfit in "Exploits of Elaine" Film. The Latest Film Plays Are Using Extensively, Applied Scientific Apparatus and Methods.**

**Fig. 1. Shows Miss Pearl White in "Exploits of Elaine," Being Resuscitated by Electricity. Fig. 2. The Telegraphone in Use. Fig. 3. Receiving Wireless Messages by Code "Sparks," and Fig. 4. Seeing by Wire or the Telephot."**

## THE ATOM.

Sir William Crookes recently said, "We are on the brink of striking developments in our knowledge of the structure of the elusive atom." An expressive phrase is the "elusive atom," for every attempt to discover it has been to chase it further into the darkness. When Sir William says "on the brink" he means that point in the chase where mechanical means have done their best and material definitions no longer apply. Just over that brink is something besides matter. It is force or spirit, and all one can know of it is its testimony in terms of light, heat or electricity.

It has long been suspected that matter is a mode of motion, and now the elusive atom will be called upon to substantiate it. That is the purpose of science today. Suppose it succeeds and this whole universe is only an expression of power, what affect is that going to have upon our philosophy, our theology and human destiny itself? If man is only a little bunch of electricity, what is going to become of that electricity when he is no more? Since force is indestructible it is a very interesting question.

---

A 50-watt tungsten lamp costs one-half cent per hour to burn, with current cost of 10 cents a kilowatt-hour.

## NOVEL A. C. FAN MOTOR.

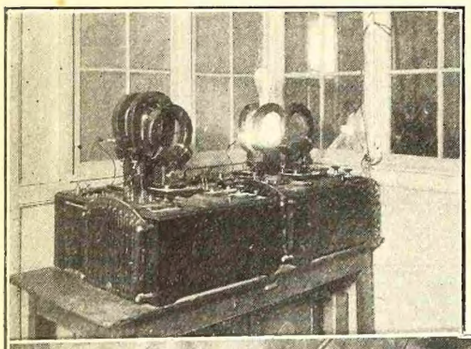
A new alternating current fan has made its appearance in which variation of speed is obtained not by means of a rheostat, but by rotating the windings of the fan. The advantage of this is that the fan may be started at any position of the winding without danger of burning out by merely operating a push button. The energy that is consumed by the fan varies with its speed. When this fan is operating at full speed it takes 24 watts, and at the lower speed it consumes about 7 watts.

---

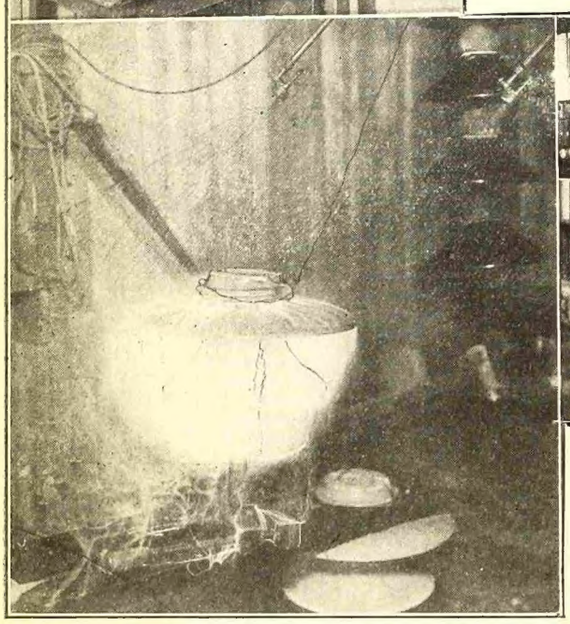
One mechanical horsepower (H. P.) is equal to 33,000 foot pounds.

# The Work of the Electrical Testing Laboratories

The rapid development of the electrical industry has made necessary the solving of a great many electrical problems. To meet this condition a corporation has been formed in New York State for the purpose of making electrical tests and solving electrical problems. With the growth of the industry these activities have expanded until at the present time the Electrical Testing Laboratories, Inc., is completely equipped and has assembled a staff thoroughly experienced in electrical, photometrical and physical tests. The following photographs indicate some of the work carried on at the Laboratories.



Left: Fig. 2. Vreeland High Frequency Mercury Arc Generators.



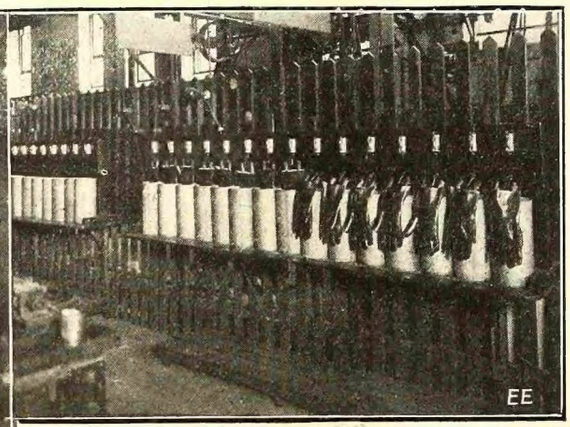


Fig. 3. Testing Electricians' Gloves Under Several Times the Voltage They Are Rated At.

Left: Fig. 1. Rain Test of High Tension Insulator. Note Arc and Brush Discharge to Pin.

Fig. 1 shows a large high tension transmission line insulator under an artificial rain test. This test is made to determine the performance of the insulator when exposed to heavy rain and wind conditions of weather, so as to determine how it will operate under the most unfavorable conditions which it may be called upon to withstand. This insulator is being tested to determine the point at which an arc will form around the insulator. In this case it is about 130,000 volts. Water is applied in a fine spray from nozzles at an angle of 45 degrees from the plane of the insulator, the amount of precipitation being one inch in five minutes. Many such insulators are purchased subject to the Laboratories' inspections and tests, the Laboratories' inspectors being sent to the insulator factories to make the tests in order to facilitate shipment. At this time over 750,000 insulators have been submitted to the Laboratories' tests.

Fig. 2 shows two generators giving a current having a pure sine wave shape. They are known as Vreeland sine wave oscillators and are used in testing at telephonic frequencies. The two machines are of similar construction, consisting of a mercury vapor tube so connected to condensers and inductance coils that the impressed *direct current* is transformed into a *high frequency alternating current*. These inductance coils are the two parallel coils at the back as seen in the picture. The third coil in front is the secondary coil from which the current is taken. The range of frequencies for the two machines as shown is 120 to 3,000 cycles per second. Other frequencies can be obtained by varying the condenser or by inserting other inductance coils.

At Fig. 3 is shown the method of testing electricians' rubber gloves. For this test the gloves are filled with water and immersed in a pan of water, one terminal being connected to the water inside the glove and the other terminal to the pan. The gloves are tested at various electrical pressures, depending upon the service which they are expected to perform. The gloves shown in the picture were tested at 10,000 volts for five minutes. In this test the electrical pressure is great enough to puncture the glove in any part which is defective. Tests of rubber gloves are, of course, vitally important, as the safety of the wiremen who must work on live circuits is on of the first considerations.

The photographs shown merely indicate three of the activities of these wonderfully well-equipped laboratories. There are hundreds of tests made by this company which might be described in the same way if the space would permit. The foregoing is given as a sample of the kind of service performed.


# LAST CALL

*Beginning with July 1st the subscription price of THE ELECTRICAL EXPERIMENTER goes to* $1.00. *It is to your interest to subscribe now while the price is so low. THE ELECTRICAL EXPERIMENTER is the greatest value today in Electrical Literature. If you intend to subscribe to it, do it now. One year, 50 cents; 2 years for* $1.00, *3 years for* $1.50. *5 YEARS for* **$2.00.** *(Foreign postage to be added.)*


## CATCHING FLIES BY ELECTRICITY.

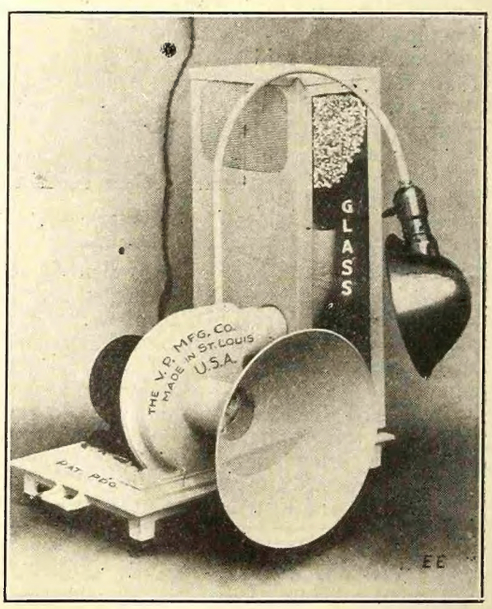
Think of it! 5,593,720,000,000 is the normal number of flies a single fly will produce from April 15 to September 10, according to the official statement of Dr. L. O. Howard, U. S. Government expert.

The electrically driven suction fan and cage here portrayed has been especially designed to meet a long felt want and is besides economical to operate.

By looking at the illustration one not familiar with a suction fan can easily comprehend the operation. A powerful suction fan is attached to the motor and the air, dust or insects that may be drawn into this fan are blown into a steel cage. Various types of mouthpieces are furnished with this machine, and extensions of 2-inch pipe can be made in any direction to catch flies, dirt or insects.

The feature of the sponge that is added to this enables one to putrify the atmosphere by water, a little drip cup at the top of the cage, which moistens the sponge, makes the sponge absorb the dirt in the atmosphere. The cage is easily removed. The light attached to the stand is for the purpose of attracting insects at night time, the mirror is placed in position with removable clasps; during the day time any sweet material placed at the openings will attract the flies. It is necessary to provide bait to attract flies. Banana oil or banana peel, stale beer or molasses attracts. It can be set in out of the way places and pipe connections made, or it can be set where most flies or insects accumulate. The machine weighs approximately 30 pounds and is thus portable and very easily moved from place to place. It consumes as much power as a 16 candle power carbon lamp.

The value of this machine to commission men, butchers, restaurants, bakers, slaughter houses and, in fact, any place where flies accumulate cannot be estimated.




Electrical Machine That Attracts and Catches the Terrible Fly.

The D., L. & W. R. R. recently conducted successful wireless telephone tests between a moving trains and station set, over a range of 63 miles, in mountainous country. Regular business made up the messages.

The average person is equivalent to 1/7 of a horsepower, as demonstrated by actual laboratory tests.

# An Interview With Nikola Tesla, Electrical Wizard

By Samuel Cohen

THERE is no doubt about it—your heart does beat faster when you are about to meet a famous electrical scientist, one of the foremost in the world. Before you go you don't think so. It didn't beat a second faster when you entered the outer office, perhaps; but as I stood on the threshhold of the big waiting room where Mr. Nikola Tesla does his day's work my nerves were highly strung. Why? Why hadn't I felt like this when I had talked to other great inventors and scientists? I had been impressed, truly, by these men, but not to any such extent as when I entered the room where the master electrical wizard lives; he who has produced electrical discharges resembling lightning bolts.

After a few minutes, I was ushered into the presence of Mr. Nikola Tesla, who stood in the corner of the room awaiting me. I asked him regarding his latest achievements, but Mr. Tesla only smiled and told me first of some of his experiences some years ago, when he produced some of the largest electrical discharges ever attempted by man. He spoke of some of his wonderful experiments with high frequency currents at high potentials, which he made in 1899. The photograph Fig. 1, herewith shown, is one of the large Tesla apparatus for the production of very high frequency, high tension currents. This apparatus was built in 1899 for his plant at Colorado Springs. At this plant and in the same year he made a number of valuable discoveries. Among these was one on which a patent was recently granted to him. This patent covers the method of production of extra large electrical discharges, such as here shown.

This display of sparks will be the more appreciated when it is stated that the streamers from end to end measure 70 feet and the current leaping into the air is 800 amperes, with a maximum potential of 12,000,000 volts. The power supplied to this machine was 300 kilowatts. These voltages are high enough, but Mr. Tesla designed larger apparatus capable of reaching a tension of 100,000,000 volts. A machine of such power must be handled with the utmost care, as the slightest carelessness may kill the experimenter; even if he were at a considerable distance from the machine. Mr. Tesla stated that he had had several narrow escapes while experimenting in 1899, caused by "balls of fire" striking out into the atmosphere.

**Top Photo Shows Largest Sparks Ever Produced by Man. Mr. Tesla is Seen Sitting. Seventy Feet Across Spark Streamers. Lower Photo. Mr. Tesla and His Marvelous Wireless Light.**

The metal balls of the coil here shown are 80 cm. in diameter. The current oscillates at a frequency of 75,000 cycles per second. Some of these discharges were two and one-half times as large as common lightning discharges, and they could be heard twelve miles away from the apparatus. Mr. Tesla is observed seated and reading one of Faraday's scientific books.

This remarkable man has spent a fabulous amount of time and money in perfecting his apparatus for the transmission of electrical energy without the aid of any wires. The smaller photo, Fig. 2, shows Mr. Tesla holding in his hands a 14-inch glass bulb, which is highly exhausted and containing a drop of mercury. The electrical power received by this tube is obtained from a loop of wire located behind the screen, which is supplied with an ultra-high frequency current. The tube was not connected in any way to the apparatus. As soon as the current was sent through the wire loop a high potential current was induced in the bulb, which vaporized the drop of mercury, causing it to give forth a blinding light of thousands of candle-power. The photograph was taken by the light of this tube, with an instantaneous or snap-shot exposure. Mr. Tesla has a

(*Continued on page 45.*)

# Baron Münchhausen's New Scientific Adventures

By Hugo Gernsback

**YOU will chuckle with glee over the latest exploits of Baron Münchhausen. This is no doubt *the* scientific serial of the year. It accomplishes something unusual, it amuses while it instructs you. And by the way: just WHAT makes an apple fall from a tree? And what do *you* know about the mysteries of Gravity? The wily Baron will tell you.**

## How Münchhausen and the Allies took Berlin

I CONFESS that I put in a bad night after my first wireless telephone talk with the Baron on that memorable December night. My dreams were wild and fearsome and I awoke at frequent intervals bathed in perspiration. The whole thing was so uncanny, so preposterous, that when I finally awoke the next morning I began to really doubt if the whole thing had not been a wild, extravagant dream.

As yet I had not told anyone about Münchhausen for fear of inevitable ridicule, so when noon came around I had become thoroughly convinced that I had dreamt the whole thing from beginning to end. But when I sat down to lunch and my elder brother asked me why I had knocked him down on the stairs on his return from the lodge the night before, I knew that the episode was not a dream after all. So I told my people of my experience and recited my conversation with Mr. Münchhausen. They did not wax very enthusiastic as the story proceeded. When I had finished, my father took a deep breath, gave me a queer look and tapped his forehead with his index finger. That was the extent of his comment. He then gave vent to a disgusted snort and started with the soup.

My younger brother sung to the tune of *"Apple-blossom time in Normandy":*

"When the Nuts are getting ripe in Squirreltown!"

My older brother remarked casually that he had read not so long ago about an eminent Eastern doctor who found that strong wireless waves had the peculiar property of producing little explosions inside of the brain. A coherer action, as it were. This he said produced what the doctor termed a "wireless brainstorm!"

"A rather dangerous disease, closely resembling hydrophobia," my brother remarked, before attacking his stew.

The rest of my family all made similar intelligent comments, and as the case proved hopeless, I kept quiet and said nothing.

That evening, however, shortly before 11 o'clock I summoned the yawning, obstreperous members of my family to the wireless room and installed on everyone's head a wireless telephone headset, which latter were connected to my own trusty receivers. I then told my little audience to watch the clock and be prepared to listen to the most remarkable discourse ever held between two humans. Nor did I disappoint my audience. The clock had hardly finished striking the eleventh hour, when the (to me) familiar high-pitched screaming sound was heard again, and a few seconds later Münchhausen's voice vibrated powerfully in my own, as well as my audience's receivers:

"Good evening, my son," he said in his sepulchral voice, "I trust you have had pleasant dreams and that last night's experience has not disturbed you too much."

I hastened to reply that I was doing nicely, but that I found it difficult of persuading my doubting Thomases that his Excellency had really come back to life. At this Münchhausen laughed heartily and said he had expected that much. He added that if further proofs were wanted, he would be happy to give another lunar exhibition. He volunteered in addition to sweep the moon's dark quarter in any color we desired this very night, in order to convince even the most skeptical that his return was not a hoax. I could tell by the faces of my hearers that they were beginning to become impressed. A vote of the audience held right then and there determined the color to be green. I transmitted this intelligence at once to the Baron, whereupon he promised to light up the invisible dark quarter of the moon in a green phosphorescence for the duration of 20 seconds, beginning at 11.30 p. m. He added that our conversation was to be resumed after the "performance."

We thereupon repaired to the roof of the house, everybody keyed to the highest excitement by this time.

I will not go into lengthy details; suffice it to say that, true to his word, at exactly 11:30 p. m. Münchhausen swept the dark part of the moon's surface with an immense shaft of a green phosphorescence, similar to the exhibition he had given to me the night before. If anything, the light shaft was more powerful; this, however, might have been due to the earth's atmosphere being clearer than on the previous night.

I need not go to the trouble of explaining that every one of my family was thoroughly convinced. All were silent and awe-struck, and all were as ready as myself to believe anything that Münchhausen might say, and I assure you I was convinced throughout.

After the exhibition we resumed our seats in the wireless room, and I suggested that my brother take stenographic notes of the conversation, he being an expert stenographer, having been a reporter on the *New York Times* for five years.

I may add, therefore, that all conversations between Baron Münchhausen and myself, which I shall publish hereafter, are exactly as stated, taken from my brother's stenographic reports. The original notes are open to anyone doubting their truth.

After we had all been seated and the excitement had cooled down somewhat, I started my generator, tuned to 80,000 meters wave length, and spoke into the transmitter before me:

"Your Excellency, are you there?"

"Yes, indeed, my dear boy," it came back in encouraging tones; "now I suppose I will be bombarded with '42-centimeter' questions for the rest of the evening! What? Let it be known, therefore, that Baron Münchhausen is, as usual, ready for all emergencies. Pray, proceed!"

"Thank you, indeed," I responded, gratefully; "you are taking a load off my mind, for I certainly have quite a few questions for you. My first question, most naturally, is, 'How came you to select me with whom to converse?'"

"For two reasons: The first being that I knew you to be a truthful individual, the same as myself, far-famed and known as such in your country. The second reason is because I could hear your wireless signals, right here on the moon, proving to me that you were probably the only one with whom I might converse on Earth. My judgment, as usual, proved correct."

"Thank you for the compliment," I replied. "Now for my most important question: 'How on Earth have you ever landed on the Moon, and why?'"

The Baron laughed outright at my pun, and proceeded:

"That's a rather long-winded story, but I will try to explain.

"As I told you last night, when I came back to life, I had found myself in my old secret room. After my visit to the Mayor I returned to this room and proceeded to remove my treasure of 10,000 gold ducats which I had intended to take with me on my contemplated secret flight 110 years ago. It seems that instinct prompted me to exchange this currency for paper money at a local bank that very day. A lucky thing for me, as you will see shortly. You will believe me when I state that I slept easier that night, with those 20,000 ducats, exchanged into modern thousand mark bills, tucked away securely in my ancient wallet, under my pillow."

"But, your Excellency," I broke in, "did you not say a minute ago that there were but 10,000 ducats?"

"H-m. That's correct," chuckled the Baron, "but, my dear boy, you seem to forget entirely that gold ducats of the vintage of 1790 sell at a very high premium to-day, on account of the great scarcity of these coins! As a matter of fact, if I had peddled these coins to coin dealers and private coin collectors, I have not the least of doubts that I could have realized a great deal more.

"The next morning I was awakened by a fearful racket. It seems that word had traveled around that I was back to life, and my enthusiastic townspeople were bent on celebrating my return in a befitting manner. There were about ten brass bands in front of my house, and I estimate that at least three-quarters of the population were assembled around the bands waiting to see me. I dressed hurriedly and stepped out on the balcony, greeted with deafening *'Hochs,' 'Vivat Münchhausen'* and *'Lang soll er leben.'* Then someone yelled for a speech, to which I responded, delivering a befitting address for the occasion. I had hardly finished when two ladders were leaned against my balcony and two enthused *'Corps Studenten'* had carried me bodily down into a gala automobile, bedecked gaily with bunting. One of the students, in full dress, took his seat at the steering wheel, while ten others, also in full dress, started to pull the automobile in a triumphant entry through the city.

"It was indeed a strange cortege, and you will find a full report of it in the German daily press of September the 30th, 1907. The town was decorated with flags from end to end in a most elaborate manner, and after a wonderful day full of speeches and all kinds of honors bestowed

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upon me the day was befittingly closed with a tremendous illumination and exquisite fireworks. The next few days were crowded with hundreds of interviews to the press and with private individuals, while attention and kindness were showered over me unendingly. I tried hard to absorb all the new customs, and I had to ask numerous questions in order to become acquainted with all the strange things I met at every hand. As usual, my well-known versatility carried me through everything successfully, and it took me less than a week of concentrated study to become a fully up-to-date man.

"There was only one point on which I remained obdurate. This was my attire. I refused to clothe myself in modern clothes. I refused to put my beloved lower extremities into those foolish, modern, overgrown sleeves which you call trousers, nor could I see a single good reason for wearing those unsightly sacks which you call coats. Neither did close-cropped hair, which destroys the individuality of man, appeal to me in the least, nor, for that matter, those fantastic straw-stalk dishes which you call straw hats. Accordingly I stuck to my style of dressing, although I confess I had considerable difficulty in finding a tailor and a hatter who could accommodate me.

"Alas! my triumph was short lived. I told you already that before I had begun my century-long sleep I had committed a certain political offense against the then reigning authorities. You would naturally think that after a lapse of 100 years most any kind of political offense would be forgotten and outlawed. Not so in my dear fatherland. In Germany a political offense is worse than a thousand murders. Official Germany, or rather Prussia, knows no time limit when it comes to *lese majeste*. To make a painful story short, one nice autumn morning I was awakened roughly with the pleasant remark:

"'I arrest you in the name of the King.' Knowing me as a resourceful character, the authorities had sent no less than six well-armed *'Polizisten,'* to make sure I would not break away.

"I was made to dress in a hurry, and before I knew it I had been placed in the 'green wagon' and hustled to the local jail, there to await trial for my political wrongs committed 110 years ago. So does Prussia treat its famous men! Luckily for me that I carried my money in the folds of my high boots, for if I had not, they certainly would have found it. So you see ancient dress has its advantages.

"I stayed for two days in that prison, and I confess that I do not know what would have become of me had it not been for my many sympathizers and admirers. To the credit of the German people's fair-mindedness, distinguished from German officialdom, let me state that I owe my release. For at the end of two days, in the middle of the night, some 30 masked young men, all admirers of mine, rushed into the prison and overpowered the keepers and attendants, and I was put in a large automobile and rushed away in the dead of a moonless night. I was quickly conducted to a small town, where I lived in disguise for some weeks.

"Subsequently I made my way to the Dutch frontier, where I breathed easier, for I knew that I was safe from all danger here. The next day found me in Paris, where I settled down in one of the suburbs, with deep bitterness in my heart against official as well as officious Prussia.

"For the next few years I traveled extensively in Europe and America, as well as the rest of the world (with the exception of Germany), and in the course of my travels I had a great many adventures, which I hope it will be my pleasure to relate to you in the near future. Returning to Paris in 1910, my mind, which had always been of a scientific bend, turned to the study of electricity and chemistry, as well as to general physics, and in a short time I had made hundreds of wonderful scientific discoveries. Not believing in patents, especially in France, with her antiquated patent laws, I patented none of my inventions. Some day I hope it will be my pleasure to publish all of them for the benefit of humanity.

"The outbreak of the great war of 1914 found me in the midst of the study of several new inventions which I was trying to perfect. But I welcomed the war, nevertheless, with a glad heart. Here at last was my long hoped for chance to get even with Prussia against whom I had nursed a growing hate during the past few years. My *'révanche'* was at hand.

"The war had not been in progress for two days when I received an urgent call from my friend President Poincaré, of the French Republic. I called at once at the palace and was greeted cordially by the President, who shook me warmly by the hand. Only one other person was present, namely, General Joffre, chief of the French army, whom I had known intimately for the past few years. He also welcomed me and patted me affectionately on the back. I could see by the expression on their faces that some very serious business was to be transacted, and I did not find myself mistaken.

"'*Monsieur le Baron,*' the President began in a businesslike manner, 'from our past acquaintance I know you to be on our side, despite the fact that you are a born Prussian. Am I correct in my assumption?'

"'Yes, *Monsieur le Président,*' I replied fervently, 'it was my misfortune to be born in Prussia, but I assure you that there is to-day no more ardent, patriotic Frenchman in France than myself. Down with the tyrant Prussia!'

"'*Très bien,*' the President replied, gratified. 'I thank you. I will have you sworn in at noon to-day. As I know that you have made certain far-reaching inventions, I trust that you will do your utmost to turn these to the benefit of our great Republic. Any assistance which you might require will be given to you by the Government, and you will co-operate with General Joffre to destroy the enemy.

"'The French General Staff has already decided to invade Germany, by way of Alsace, in order to regain our lost provinces. Your efforts for the present, therefore, should be confined to that territory until your presence will be required elsewhere.'

"I thanked the President profusely for his great confidence in me, and hastened to answer him that I would not rest till the enemy was destroyed. I made it a condition, however, that I should have the power of requisitioning anything, no mat-

**"In Less Than One Second Over 500 Men Were Baled Together Tighter Than a Bale of Compressed Cotton.**

ter what it might prove to be, if in my opinion it was essential to use it at the front. This President Poincaré promised gladly.

"'All the Government desires, just now,' he closed, 'are results and victories over the enemy. France is at your service.' With these words we shook hands solemnly and the President left me alone with General Joffre.

"For several hours Joffre and I discussed various phases of the war, and after I had thoroughly acquainted him with some of my revolutionary plans of warfare we parted in high spirits.

"That very night I requisitioned every tank of laughing gas, as well as every carboy of chloroform, in the whole of France. I furthermore ordered every factory producing these articles to work overtime for 24 hours each day until further notice; immediately thereupon I requisitioned an immense factory at Levallois-Perret, a suburb of Paris, where for the next few days I kept 8,000 people busy manufacturing my requirements.

"You know, of course, of the French invasion into Alsace at the beginning of the war, and how we penetrated even beyond Mülhausen and Kolmar. But did you know how it was accomplished, and by whom? I think not. When history is finally written you will find that it was I who make the difficult work possible. I personally conducted the invasion and it was, indeed, a brilliant success. The first clash with the Germans was spectacular. We rushed upon them in the early morning, but instead of our artillery using the ordinary explosive shells we used my compressed laughing gas cylinders. These were constructed in such a way that they would open upon striking the ground. The soldiers of the rank and file were equipped with a similar device, who, instead of shooting bullets, shot compressed laughing gas cylinders. These cylinders were shot from the rifle at a rather close range and were not supposed to penetrate the bodies of the enemy. Instead, the cylinders had a soft rubber nose which, upon striking, actuated a trigger, and this in turn opened the forward end of the cylinder, releasing the gas.

"Our first attack proved as great an astonishment to us as to the enemy. When we began shooting the laughing gas at the oncoming ferocious-looking Germans their expressions changed suddenly to abominable grins. Most of them reeled and dropped right in their tracks; we had but to pick them up afterward as prisoners. I remember in a single day we thus captured 8,000 Germans.

"After the first rush we drove them back to their second line of trenches, and it was here where my chloroform bombs did wonderful work. Our artillery began shelling the trenches with my bombs; these, on striking the ground, liberated the compressed chloroform with disastrous results to the enemy. We literally drenched the Germans with chloroform, and those not killed outright were picked up later to be sent to France as prisoners, where they were put to work at manufacturing more laughing gas and chloroform with which to capture their countrymen.

"Thus we fought our way to Mülhausen, which we occupied triumphantly. I have no doubt that I would have fought my way across the Rhine, but just then Joffre got into trouble in Belgium and retreated into France. On his urgent representation I rushed to his aid, leaving my Eastern army in the hands of a young General whom I thought capable of continuing our Alsatian invasion.

"Unluckily, the Germans became wise to my bombs and began using some form of diving helmets, fastened over the heads, which kept the fumes and gases from their noses and mouths. This of course counteracted my bombs and made them obsolete. The Germans subsequently appeared in great force and drove my Alsatian invading army practically from Alsace, finally leaving it entrenched in the Vosges.

"In the meanwhile General Joffre had retreated almost to Paris before I could rush assistance to him. I am proud to state here that had it not been for me, Paris, as well as the rest of France, would have been in German hands. But Germany had not included Münchhausen in her plans of invasion.

"The great German General Von Kluck was but a few miles from Paris when I went into action. For a long time it has been a deep mystery to many people why he did not take Paris at that time and why he retreated so mysteriously and with so much haste beyond the rivers Marne and Somme. The explanation is found in the one word: Münchhausen. I had long since discovered that the German advance could not be stopped by ordinary means, so I adopted extraordinary measures.

"As is well known, France had been poorly prepared for the war. While there were unlimited stores of powder and gun-cotton, the artillery was sadly deficient in shells and our soldiers lacked bullets. As the manufacture of these important items is rather slow work, I commandeered all the French arsenals to turn out immediately rock salt shells and cartridges, which, instead of having bullets at their business ends, were filled with a goodly charge of the inexpensive as well as plentiful rock salt.

"From the minute these 'Salties' (as they were called affectionately by the French army) came into use the German advance had come to an end. We simply shot salt at the Germans.

"You may laugh at this and ask how it could have possibly stopped them, but the answer is as simple as it is surprising. The rock salt, when shot from a rifle or gun, had not enough piercing power to penetrate the bodies of the enemy, but it went easily clean through the soldiers' uniforms and then buried itself under their skins.

"If you have ever had a salty solution applied to an open wound you will appreciate what happened when I began pumping rock salt into the Imperial German army. No sooner had a soldier been shot than he would throw up both hands and begin to scratch himself furiously, with a zeal with which you would hardly credit the slow-moving Germans. Orders or no orders from his officers, *Hans* would scratch himself for dear life to get some satisfaction from the fearful itching. Finding that this did not bring the desired relief, instinct prompted him to run for the nearest water supply in order to wash the slight wounds free of the salt.

"By that time our gallant Frenchmen or British were upon them and they were made prisoners in less time than it takes me to describe it. It was quite a few days before the German General Staff got onto my latest device and promptly set out to checkmate me. One morning I received a report that my rock salt charges no longer acted in the usual prescribed manner, i. e., the Germans refused to scratch themselves when shot at. Instead, they threatened to drive us back. That afternoon we caught a few Germans and the mystery was cleared.

"The foxy German General Staff had ordered each soldier to wear TWO uniforms, one put on top of the other! Our rock salt charges could easily penetrate one uniform, but not two! Therefore I was forced to abandon my 'Salties,' and I turned my fertile brain in new directions.

"In a few days I was back to the front with a brand-new device. I am proud to say that of all schemes this one was probably the most effective. With its help we captured no less than 31,986 Germans in less than one week. President Poincaré personally attached the cross of the *Légion d'honneur* to my breast with the official thanks of the Republic. I am immensely proud of it to-day.

"As you will have noticed, all my own devices of modern warfare are exceedingly humane. If I can possibly avoid it I do not allow blood to be shed. I believe in taking the enemy alive.

"My well-known success, the *Human Self-binder*, illustrates this point.

"You are, of course, acquainted with the self-binder as used in harvesting. You know how the machine bales the wheat, putting a stout cord around the circumference of the bundle, holding the stalks together securely.

"This is the principle used in my *Human Self-binder*. It is simplicity itself and works as follows:

"Two of the famous French 75-millimeter guns were placed about 150 meters apart from each other, facing the oncoming enemy. The guns were loaded in the usual manner except that the shells were equipped with an eye-ring at the end facing the enemy. To this ring was fastened securely a strong but flexible steel cable about as thick as your little finger. Before firing, the cable would run into the mouth of the first cannon, while the other end of the cable was fastened to a similar shell in the second cannon 150 meters distant. Then the two guns were adjusted in such a manner that the cable was almost taut; the cannons themselves were leveled almost parallel to the ground. When the command was given the two cannons were fired simultaneously by means of electricity. The result was fearful when we first tried it on a regiment of charging Germans.

(*Continued on next page.*)


# Can You

write a snappy, short story, having some scientific fact as its theme? If you can

# Write

such fiction we would like to print it. The story which is appearing in the ELECTRICAL EXPERIMENTER at present has aroused so much enthusiasm among our readers that we have decided to publish more

# Stories

from time to time. If you have the knack, try your hand at it. It is worth while. However, please bear in mind that only scientific literature is acceptable, altho not necessarily dealing with electrical subjects. "Baron Münchhausen" is a good example. Suppose you try. We pay well for such original stories.

# "Electrical Dog" Follows Beam of Light

THE "soul yearnings" of a brand-new animal were recently expressed before a large and enthusiastic audience in the Auditorium, Chicago.

This new matinee idol is "Seleno," the Electrical Dog, created and trained by B. F. Meissner, of U. S. Navy wireless and torpedo fame.

Seleno believes in hitching his wagon to a star; although a "star" himself, he follows a guiding light ray with absolute fidelity, a veritable chemico-electro-mechanical successor to the Magi of old.

Seleno is a barkless, biteless, hairless, tailless, semi-immortal phenomenon whose appetite calls only for currents—electric currents—that is—volts and amperes. His digestive apparatus is a storage battery, "fed" from the lighting circuit whenever he feels hungry. He moves on rubber-tired wheels in pursuit of the *beam of light* which he "sees" by means of two four-inch condensing lenses which constitute his eyes, and a pair of selenium cell optical brain centers. An electric motor actuates his drive gear and electro-magnetic relays control his course. His nose plays an important part in his following" ability, inasmuch as it is a thin opaque plate located between his "eyes," which shades one or the other eye when the light beam is not coming from directly ahead of him, causing his selenium optical centers to be unequally affected, the principle underlying his steering ability.

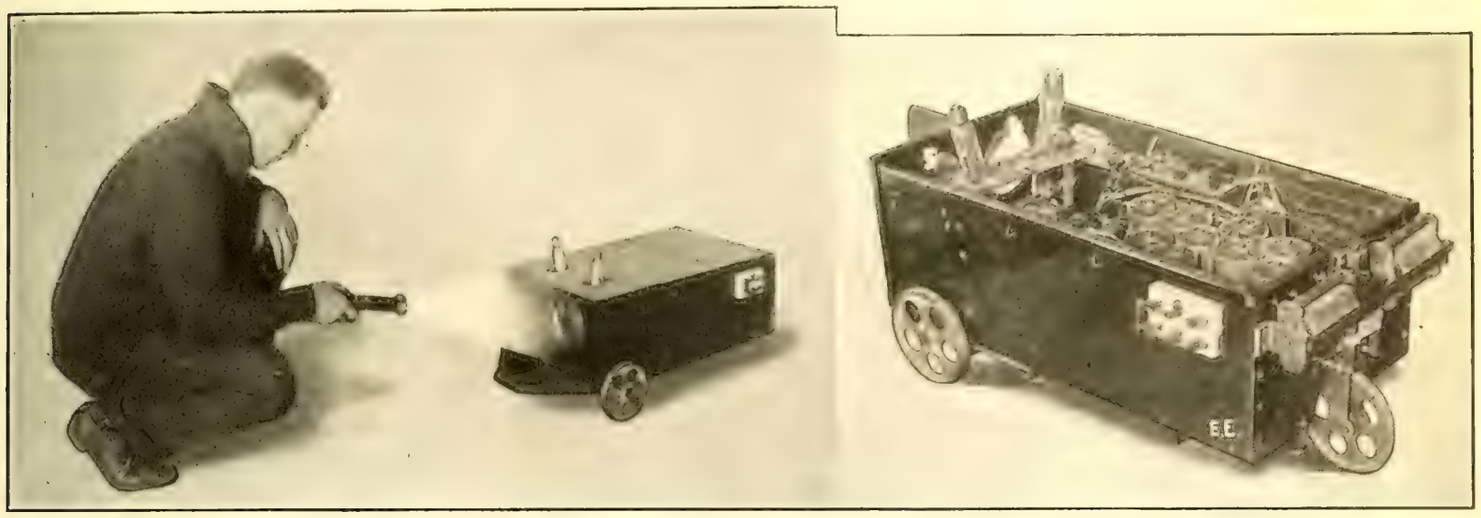
The most fanatical "Sun Worshiper" has nothing on Seleno. He would pursue a beam of light to its source, even to destruction; wherefore his master has endowed him with a reversing trigger as a preventive against suicide.

The few Chicagoans who have already been privileged to be present at a private recital by Seleno enthusiastically agree that he is beyond all question a "hound."

Mr. Meissner has developed several understudies, accomplished relatives of Seleno, who "support" him in his "act," demonstrating the remarkable properties of selenium in other startling ways. These lesser stars resolve the mystery of Seleno's fanaticism. A beam of light, directed upon a selenium cell, which is a non-conductor of electricity in the dark, lowers its resistance to the flow of current instantly; so in connection with a relay (or electro-magnetic switch), it can control the energy supply of any electrical device, from a simple incandescent lamp to an electric locomotive or smelting furnace. Likewise, it has been proved in Mr. Meissner's experiments that the deadly naval torpedo or even an automatic bomb-dropping aeroplane can be maneuvered in action from ship or shore by the same wonderful controlling agency.

By means of a small hand flashlamp directed at the "dog's eyes" (lenses behind which are mounted selenium control cells), his master causes the curious box on wheels to follow him about the stage, turning corners and avoiding chairs with no other control than that of the beam of light. By reversing a switch on the "dog" the mechanism was similarly made to back away from the source of light. The "dog" in each case started into motion quickly when the light was thrown onto its lenses and stopped just as promptly when the lamp was extinguished or turned away.

Storage cells inside the case furnish energy to drive the motor which propels the "dog." Each of the selenium cells behind the eye lenses controls a relay which actuates the motor and one of the two steering magnets at the rear of the device. Illuminating a cell on one side starts the motor and turns the rear wheel to that side; illuminating both cells equally causes the mechanism to run straight forward. Thus the action of the control mechanism is to keep the two lenses always equally illuminated and pointed at the source of light—in whatever direction that source moves.



"Seleno," the Electrical Dog, Obeys His Master Faithfully. Righ Hand View Shows Inside of the Dog.

## BARON MÜNCHHAUSEN'S NEW SCIENTIFIC ADVENTURES.

*(Continued.)*

The two shells leaped forward together from the cannons, carrying the steel cable with them, now stretched taut. The cable, cutting through the air at a tremendous rate of speed, made a frightful, screeching noise. It 'sang' so loudly that it was easily heard over a distance of 35 miles. It was awe-inspiring.

"Have you ever as a child swung a cord with a stone at one end? If you have, you will have noticed how the string 'sung' louder and higher in pitch as you increased its speed. So it was with the steel cable, only the sound was increased a few billion times over that of your string. It went somewhat like this:

**WHHEEEEEEEEE EEEE-EEE-EEE eeeeeeeee eeeeeee e e e e ehh . . . . . .**

"The two shells then plowed their way through a few dozen soldiers, while the cable, catching the foremost men amidships, as it were, was stopped short, while the shells, carried forward by their momentum, continued to travel in their forward movement until stopped short by the cable. However, the momentum then carried one shell around to the left, while the other went to the right. In less than one second over 500 men were baled together tighter than a bale of compressed cotton, and as helpless as the latter. Most of the men at the point of contact with the cable were, of course, crushed to death by the tremendous pressure, but those on the inside, while nearly all of their breath had left them for the time being, were alive and were easily made prisoners by us.

"You have probably often wondered why, after the retreat of the Marne, the Germans dug themselves into their famous trenches. The answer is that this was the only means of escape from my human baler. As soon as they had found that they could not rush at us over the open terrain they went into their trenches, which naturally put my self-binder *hors de combat,* or out of business, as Americans are fond of saying.

"This put me at my wits' end for a few weeks, but not for very long. At the end of October, 1914, when all efforts to oust the Germans from their trenches had failed, I went to see General Joffre and said to him:

"'My dear General, we must now resort to a novel means in order to crush the enemy. Here is my plan: The Allies are now spending untold millions each day and no headway is being made against the Germans. Why not take 20,000 picked men, who know how to dig and mine, and order them to build a few gigantic tunnels right under the German trenches, emerging in some forests miles behind the German lines? Upon a given signal our armies would break through the openings and, while half of our men would fall into the enemy's back, the other half would be well on the road to Berlin. Simple, is it not?'

"General Joffre's enthusiasm over my plan knew no bounds. This otherwise silent man fell around my neck and embraced

*(Continued on page 72.)*

# The White Feather

WIRELESS on the stage is not a novelty any more in these days. In the past, it has been used to a large extent to key up an audience in order to picture the emotions of a ship's wireless operator either when his own ship is in distress or when he is engaged in rescuing another ship. This phase having been worked to death, Messrs. Lechmere Worrall & J. E. Harold Terry left the beaten track and present us with the *Spy Wireless*.

"The White Feather," now running in its third month in the Comedy Theatre at New York, draws nightly large crowds, who seems anxious to enlarge their knowledge with the workings of the modern wireless spy.

The action takes place in an English town somewhere near the coast. Mrs. Sanderson and her son, both naturalized Germans, run a boarding house, but they are spies in the employ of the German government. Christopher Brent, an Englishman, considered an idiot by all, is a boarder. Everybody upbraids him, and a patriotic girl offers him a white feather as a token of her disgust, because he has steadfastly refused to enlist, nor can he offer a good excuse why he stays at home. He is, however, —Sh-H— a secret spy in the employ of the British government!

Left alone in the parlor, he empties the ashes from his pipe by knocking the latter against the casing of the fireplace. It sounds hollow. Very queer! Brent starts to thinking. He fumbles about the grate for some time and accidentally touches a secret spring, and— presto, the fireplace, which is but a dummy, swings upon its pivots and lo— a neat little "wireless" pops out, as faithfully depicted in our illustration.

The "wireless," made entirely of *"Electro"* instruments, is of course only an amateur outfit and is used by the Sandersons in transmitting important messages to the German submarines, lying outside the harbor, but a few miles distant from the house.

Whereupon Brent uses the outfit himself, gets all the information he needs by wireless and proceeds to put the outfit out of commission by wrecking the detector. Then he swings the outfit back into place and later on, by means of the knowledge thus obtained, also using a Detectiphone to good advantage in the evening, he finally rounds up the spies in a spectacular as well as exciting manner, wins the girl who almost became convinced that he is a coward and everybody is happy ever after.

Also, be it said here, Christopher Brent, who in everyday life is plain Mr. Albert Brown, is the "whole show." He has a difficult rôle and he acts it admirably.

**A Breathless Moment in the Play, "The White Feather," When the Hero Picks Up German Spy Wireless Messages.**

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Six thousand eight hundred miles of hard-drawn copper wire was used in the recent long-distance telephone test between New York and San Francisco.

## ELECTRICITY IN PLANT LIFE.

Some plants are electrically weak, others are strong, says Royal Dixon, autnor of "The Human Side of Plants," in the *Edison Monthly*. Perhaps the strongest; that is, in the sense of electrical vibrations,

**An Electrically Sensitive Plant, Known as the "Mimosa Pudica."**

is the sensitive plant (*Mimosa pudica*) shown in the illustration. Others, such as iris, nicotiana, nasturtiums, and practically all the meat-eating plants, such as the "Venus fly-trap" and the "sundew," afford splendid examples for experimentation. If any of these be placed "in connection with a galvanometer by means of electrodes attached to leaves on different sides, and one side of the plant be exposed to sunlight while the other side is kept shaded, then within from three to 10 seconds after exposure to sunlight there will be a flow of electricity from the lighted to the shaded parts amounting to .005 to .02 volt. This continues for about five minutes, when the magnet begins to swing back and shows an opposite current of considerable magnitude. The manifestations are similar to those of "teranized nerve."

A better understanding of the electrical qualities of plants will, no doubt, explain many of the hitherto mysterious habits of meat-eating plants. Especially will this be true of such terrible and uncanny plant monsters as the "devil's snare" of South America and the mammoth Utricularia, or fishing plant, which lures minnows and small animals into its voracious mouth, and suddenly, as if an electric button were secretly pressed, closes in upon its helpless prey. In other words, it fishes with a net electrically wired! Strange as it may sound this plant safeguarded itself by means of its electrical currents ages before we used the electric burglar alarm and door bell. Were it not for this protection, the plant could not live and hold its own in such an aurial-infested region as it needs for its fishing ground.

Many strange stories are told of a vampire vine, commonly known as the "devil's snare," which grows near Lake Titicaca in South America. This uncanny vine is like a huge snake and it is supposed to be able to capture wild animals as large as dogs and suck the blood from their bodies, just as an insect-eating plant catches a fly and draws nutriment from the carcass. The "devil's snare" is continually reaching out its huge white arms, which draw in every living thing that comes within its reach. This plant thrives in the inland region of the Nicaragua Canal.

A very peculiar plant, and one which has tremendous electrical powers, is the "telegraph plant" (*Desniodium gyrans*). It is a native of India, and each of its leaves is composed of three leaflets; the larger one stands erect during the day but turns down at night, while each of the smaller leaflets move day and night without stopping. They describe by means of jerking motions complete circles, not unlike the smaller hand of a watch.

## EDISON RECEIVES CIVIC FORUM MEDAL.

"Inventor and World Benefactor" was the inscription on the gold medal of the Civic Forum which was presented to Thomas A. Edison on May 6 in Carnegie Hall, as a national testimonial. President Butler, of Columbia University, who presided and made the presentation, said:

"This gold medal is not awarded for any particular achievement, but for distinguished services and great scientific achievements and in recognition of a great career, which has a place among the very highest in the roll of human history."

A brilliant assemblage of world-famous engineers and scientists were present on this great occasion.

Guglielmo Marconi, the distinguished wireless inventor, was present on the platform and said:

"It would be useless for me to say that there is the greatest admiration for Mr. Edison in Europe. If anything, it is greater there than here. Americans may well be proud of the fact that Mr. Edison is an American. I am glad for us Europeans that Mr. Edison belongs to the world."

Letters from ex-President Theodore Roosevelt and ex-President William H. Taft, Alexander Graham Bell, and others were read by Robert Erskine Ely, a trustee of the Forum. Those who lauded the work and personality of Mr. Edison in addresses were Nicholas Murray Butler, ex-Governor J. Franklin Fort of New Jersey, George McAneny, Guglielmo Marconi, President Richard C. Maclaurin of the Massachusetts Institute of Technology, Charles A. Coffin, chairman of the board of the General Electric Co., Dr. John A. Brashear, the Pittsburgh astronomer, and Dr. Charles P. Steinmetz.

Percy Mackaye recited a poem he had written for the occasion. Here are the opening stanzas:

A thousand leagues on the Arctic sea
A ship went down through the frozen floe.
Captain and crew they watched her go:
They ran her colors free;
They cheered her lustily;
And far peoples chanted her praise with them
Where a phonograph, from her plunging stem,
Pealed to the stars her requiem.

A thousand leagues through the Afric wood
A man went looting the jungle's wealth:
Leopard nor lion could stay his stealth,
Nor sleeping-death nor flood:
He drew not the monsters' blood,
But he led them alive through the scorching day
By a tape of moving film, to play
With the wondering children of Broadway.

A thousand leagues, or a thousand years,
Are motes in the gaze of the seeking mind:
By its own radiance thought can find
Its way to ultimate spheres
Dark, till its beam appears
To blazen them. So on that beam hath run—
Round Arctic moon and Afric sun—
The electric mind of Edison.

The medal, which is one awarded annually by the Civic Forum for distinguished public service, was massive and elaborate. Last year it was awarded to Col. Goethals.

*On July 1st the subscription price of the "E.E." goes to* $1.00. *Subscribe now. See page* 38.

# The Tower of Jewels at Frisco's Exposition

The Tower of Jewels, the dominating piece of architecture of the entire Panama-Pacific Exposition, is shown here, illuminated for the first time. That it does not belie its title is evidenced by its beauty when it is illuminated. There are 125,000 jewels or novagems used to decorate the tower which stands on the Avenue of Palms, and is the work of McKim, Mead & White, of New York. Each of the 125,000 jewels is backed by a mirror the size of 25-cent piece. The tower is a terraced structure, the principal features being the gigantic figures of the Philosopher, the Priest, the Adventurer and the Scholar; the work of John Flanagan, of New York. Under the tower are 44 feet long murals by Edward Simmons. This is only one of the many beautifully illuminated buildings at the exposition.

*Photo (C.) by Underwood & Underwood.*

**The Beautiful "Tower of Jewels" at Night, San Francisco Exposition.**

## AN INTERVIEW WITH NIKOLA TESLA.

(*Continued from page* 39.)

number of startling new discoveries and inventions in the electrical field, which he does not care to announce at present, and he considers these latter of greater moment than any electrical work he has so far done. He intends in the near future to transmit wirelessly speech and energy around the world from his very powerful electric wave station on Long Island, which is as yet not completed, but which will be finished soon undoubtedly. Mr. Tesla stated, "that the day will soon come when he will show the world that the transmission of power and speech without the aid of any wires is possible."

Mr. Tesla was the first inventor of the induction motor and the system of alternating current power transmission, popularly known as two-phase, three-phase, or poly-phase systems, which created a revolution in electrical engineering and are now universally adopted.

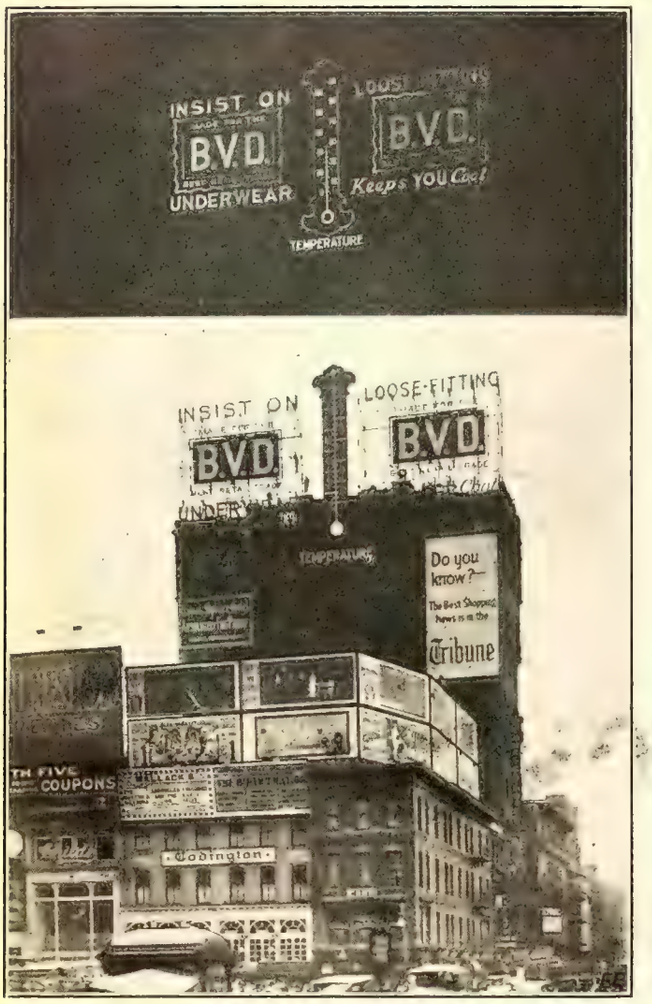
His most important recent work is the discovery of a new mechanical principle which he has embodied in a great variety of machines, such as reversible gas, steam and water turbines, mechanical transformers and transmitters of power, etc. This principle enables the production of prime movers capable of developing ten horsepower, or even more, for each pound of weight in the machine. His present prime mover could be very successfully used in the propulsion of vessels at extremely high speeds, he explained.

The allotted time grew short, and in a few minutes the great inventor bid me adieu and I left the presence of one of the world's most distinguished scientists of whom it has rightly been said: "He lives a hundred years ahead of his time."

## AN ELECTRIC THERMOMETER SIGN.

A useful as well as an efficient advertising sign has been erected in New York City at Broadway and 43d street.

This unique sign is designed with a large




**Novel New York City Electric Sign Which Tells the Public the Exact Temperature at Any Time, Day or Night, by Means of Electric Lamps.**

electrically lighted thermometer, as seen in the day and night photos here presented. The thermometer is ingeniously controlled by electrical switches and circuits so as to always read the correct temperature by day or by night. Hence the Broadwayites can easily ascertain the correct heat value by a glance at the "B. V. D." sign, which can be seen for a considerable distance. Photo by courtesy O. J. Gude Co., the erectors.

The size of the sign is 30-44 feet high by 93 feet long. Height of letters in "Insist on Loose-Fitting," 4 feet; of label, 21 feet; of letters "B. V. D." 9½ feet. The entire height of thermometer is 50 feet and its width is 7 feet. The diameter of ball at lower end of thermometer is 3 feet 3 inches.

## IS VIBRATION THE BASE OF THE UNIVERSE?

By Garrett P. Serviss.

"Is it true that when a sound is so high pitched that we cannot hear it, it turns into some color, i. e., affects our optic nerve? Is the difference of colors due to the vibrations of matter? May matter itself eventually be resolved into different rhythmic motions?, asks a reader of the *New York Journal*, who has been answered by the noted scientist and astronomer, Garrett P. Serviss, as follows:

To answer your first question, consider these facts:

Sound is due to a vibration of matter (either gaseous, liquid or solid) of such a character and frequency that it affects our auditory nerves with a sensation which we call hearing. Ordinary sounds are conveyed to our ears by vibrations of the atmosphere, which consists of a mixture of gases. These vibrations are known as "sonorous waves." According to Helmholtz's experiments, the ear cannot detect any sound if the number of vibrations per second is less than 16 or more than 38,000. But this is an extreme estimate. All ordinary musical sounds are comprised between about 40 and 4,000 vibrations per second, covering about seven octaves. The lengths of the sonorous waves corresponding to frequencies of 40 and 4,000 per second are respectively twenty-eight feet and twenty-eight one hundredths of a foot, the latter being a trifle more than three and one-third inches.

Now, turn to light. Light is due to a vibration of a medium called the ether, or "luminiferous ether," which is supposed to pervade all space, and to pass freely through all matter, while being itself exempt from the ordinary limitations and properties of matter. Just as in the case of sound, the vibrations that give rise to the sensation of light belong to a series of waves only a small part of which possess the requisite length and frequency necessary to affect the organs of sight. It is important to remember the distinction that the "light waves" are in the ether, while the "sound waves" are in the atmosphere, or some other ordinary material substance.

If the rapidity of the vibrations in the ether is less than about 460 million-million per second, or more than about 680 million-million per second, they make no impression on the optic nerve, and we see no light. The wave lengths corresponding with the frequencies just mentioned are respectively aboue one 39000th of an inch, and one 58,000th of an inch.

Within these limits notable differences in the effects produced upon the eye by waves of various lengths occur. These differences are the origin of colors. The longest and slowest of the waves included in the limits named above, produce the sensation of red; the shortest and most rapid produce the sensation of violet; intermediate waves produce the sensations of orange, yellow, green, blue, indigo and intermediate shades. When all the luminous waves are blended together in the eye, they give the effect of white light.

From what has just been said, you will see that it would be impossible for such a direct relation, as your question indicates, to exist between the vibrations of sound and those of light. A sound that becomes so shrill that it passes upward on the gamut beyond the reach of the ear may still be a sound for some creature, like an insect, with an organ constructed to respond to vibrations of very high frequency. But it could not merge into the minute etheric vibrations that produce the sensation of color without itself in some manner passing over from the realm of ordinary matter into that of extraordinary matter, which seems to be occupied by the ether.

The third question leads to speculative ground. I may say, however, that everything at present seems to indicate that motion, of a rhythmic character, does lie at the basis of matter.

## ELECTRIC LIGHT FROM WINDMILLS.

Electric lights from windmills may be very economically produced, and, in fact, is produced in this way a great deal in Europe and other countries. This practise is becoming gradually known, and utilized in the United States now; and with an installation costing $75 to $100 a fair size complete lighting plant can be installed for this drive.

Illustration shows a typical windmill electric power plant, including gearing and belt to dynamo pulley; automatic charging cut-out between the dynamo and battery, and the storage battery.

The principle on which these plants operate is quite simple. It is the same as if you had a pipe feeding into a water tank and every once in a while a quantity of water was discharged through this pipe over the top of the tank. In this way, the tank would gradually be filled although spasmodically, and the same principle takes place in the windmill electric power plant. The dynamo, whenever it is run fast enough by the windmill blade, pumps electric current into the battery. In the course of a day, the battery thus becomes fully

**Windmill Drives Electric Lighting Dynamo and Charges Also a Storage Battery.**

charged in most cases. The lamps are lighted practically from the battery then; thus preventing any fluctuation in the brilliancy of the lamps, which would take place, of course, if the lamps were lighted direct from the dynamo in this case.

C. Pinkerton, of Spencer, S. Dak., says:

"Your *'paper'* is a very interesting one and I don't want to miss a copy of it."

# Electricity in The War

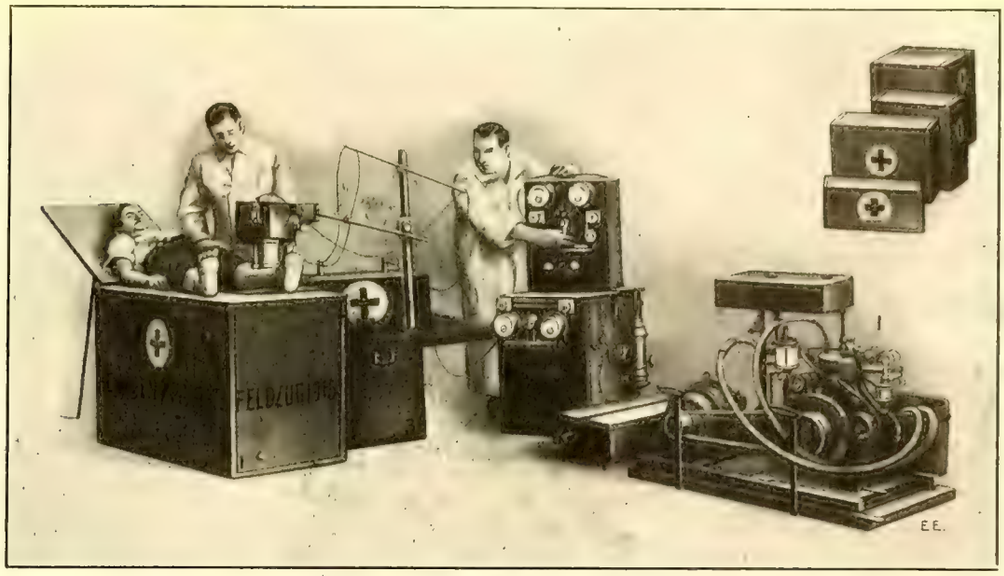
By Friederich Waldersee

*(Berlin Correspondent of the Electrical Experimenter.)*

## X-RAYS IN THE GERMAN ARMY.

X-Rays have played a very important part in the wonderful medical corps of the German Army. It is probably the most important apparatus in their military hospitals.

One type of X-Ray machine, packed in four portable boxes, is illustrated here. The X-Ray apparatus herewith shown was especially developed by a German company, and six of these machines were transported lately to the Bavarian Army.



**Ingenious Compact X-Ray Outfit of the German Army for Field Purposes.**

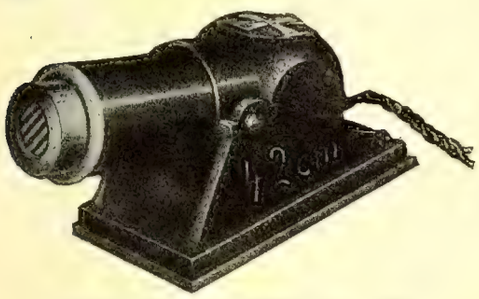
The electrical power, which the 30 cm. induction coil receives, is supplied by a dynamo driven by a gasoline engine. The case No. 1, in which the dynamo and engine is packed, also serves as an operating table when the engine and dynamo are removed, as observed. One side of the case, with suitable bracket arm, serves as an adjustable head rest. The second case contains a millivoltmeter, ammeter, and a control switchboard. The switchboard is mounted on top of the cover. It is readily removed by turning and placing it in an upright position, which makes it then ready for use. A third case serves as a container for two X-Ray tubes; the case also serves as an X-Ray tube stand and houses the tube diaphragm holder, etc., in transit.

The powerful induction coil which supplies the X-Ray tube with the high tension voltage is sealed very carefully in a special box, in order to stand all kinds of rough use. Another case, No. 4, contains a set of storage batteries for emergency purposes, such as the failure of the dynamo and engine to work.

The apparatus has plenty of work to do, indeed, as it forms one of the surest methods of locating bullets, fragments of shells, etc., which may have entered the flesh and muscles.

## NEW GERMAN WAR NOVELTIES.

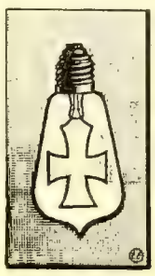
The two illustrations produced herewith give a good idea how the Germans are exploiting the war, even as to electrical novelties.



**Cigar Lighter in Shape of a Gun.**

The electrical lamp reproduced herewith is a tungsten lamp and its filament is shaped in the form of the Iron Cross. The filament is of a spiral form, and is held in position from the sides of the lamp wall by means of the ordinary wire suspensions; these are not shown in our illustration. A lamp of this kind gives a very novel effect, particularly if used for advertising purposes, patriotic fetes, etc. These lamps are at the present time made from 15 to 50 candle power and are manufactured in pear shape form as well as round globes.

Our other illustration represents one of the famous 42-centimeter guns, of which we have heard so much in the war. It is, however, not a gun and only the outside shape conforms to same. It is nothing more or less than an electrical cigar lighter in the shape of a gun; a lamp cord connected to the back of the gun is used to make connection with the electric circuit for 110 volts. A simple arrangement is provided which makes the front end glow as soon as the gun is picked up from its base; the housing is made of a brown zinc casting. The design is very pleasing, and there seems to be a good market for a device of this kind in Germany at the present time.



## ARC LAMPS IN HIGH GAS PRESSURES.

It is stated in the "Elektrotechnische Zeitschrift" that Prof. Lummer, of Breslau, Germany, has run arc lamps under pressures of 20 atmospheres absolute, and obtained intrinsic brilliancies 18 times higher than those obtained at ordinary atmospheric pressure, the calculated temperature rising from approximately 4,200 deg. C. to about 7,500 deg. C. The experiments are to be continued.

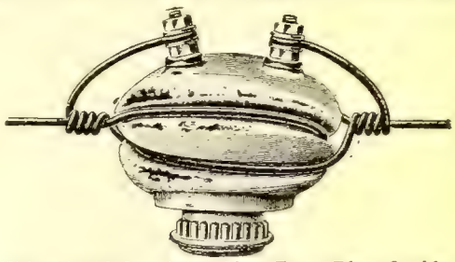
## EFFICIENCY OF THE ELECTRIC ARC.

The "Elektrotechnische Zeitschrift," (Germany), shows two developments tending to increase the efficiency of the electric arc. One of these is due to Dr. W. Wedding, who heats the ends of the carbons by means of a flat non-luminous flame, though it appears that the actual function of the flame is to cool that part of the carbons to which it is applied. From the information that is given the arrangement is not altogether clear. It is obvious that if the efficiency of an arc is to be increased, the current density in the luminous part of the electrode must be increased so as to obtain a higher temperature. Evidently this desideratum has been achieved by Dr. Wedding, as the candlepower in a certain direction is raised from 30,000 up to about 100,000 Hefner candles, although the temperature of the carbons in certain parts has been reduced.

The idea of cooling has also been attempted in this country, and in this case alcohol vapor was the cooling medium. From the practical point of view, however, increase of pressure does not seem to be a very promising direction in which to work.

## NOVEL GERMAN INSULATOR.

In a recent issue of *Helios*, a German electrical paper, appears the cut here reproduced of a novel porcelain line insulator, which combines means for anchoring

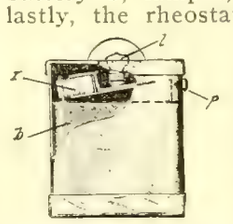


**This Novel Insulator Has Fuse Plug Inside.**

the two wires as well as a fuse plug. It is suitable for a variety of purposes, such as lighting lines and telegraph or telephone circuits. The fuse connections are brought to two binding posts as perceived.

## A NOVEL FLASHLIGHT RHEOSTAT.

A rheostat built in the flashlight is the latest German novelty. This obviates the tendency to burn out tungsten bulbs of low rating used on fresh batteries as seen from the illustration. There is the usual battery b, lamp l, push button p, and lastly, the rheostat r. This adjustable resistance r consists of a few feet of wire wound on a tube, with a slider arranged on the brass piece making contcat with the center or base of the lamp. To insert more resistance, for fresh battery, the coil is removed and the slide moved toward the right. Then it and the battery are replaced. Tungsten lamps of 2.5 to 3.5 volts rating can be used with a battery yielding 4.5 volts when fresh. As the battery ages, the rheostat enables one to adjust the voltage to the lamp as required.



## AN OBSERVATION CAR ELECTRIC SEARCHLIGHT.

By Frank C. Perkins.

The accompanying illustration shows the first electric searchlight on a railway observation car, installed on the fast mail train operated between the Twin Cities and Chicago on the Chicago, Milwaukee & St. Paul Railway. The searchlight, 13 inches in diameter, is placed on a pedestal 52 inches high over all, taking up 16 inches of floor space on the observation platform. The carbons are ½ and ⅝ inch in diameter, specially constructed for searchlight work. The carbons stand horizontally and operate automatically after being focused. The lamp is built to operate on a 60-volt electric current, and requires 20 amperes, throwing a stream of light for a distance of two miles.

**The Latest Attraction on a Western Railroad Train. A Powerful Searchlight Illuminates the Scenery at Night.**

It is stated that the condensed view of the light after leaving the reflector is equal to 4,500,000 candle-power. It will be seen that the lamp is mounted on the observation car platform at the end of the train and it is in charge of an experienced operator, providing a means by which the passengers on the train can view the scenery after nightfall. The St. Paul Railroad runs parallel to the Mississippi River for over 100 miles, and the boats, curious rock formations and the features of the landscapes come out clearly in a very interesting manner by the use of the powerful searchlight. The searchlight can be moved 90 degrees horizontally and 45 degrees vertically, thus making objects visible for a distance of several miles around as the train speeds along.

## READER'S VOTING BLANK.

What do you like best in the *Electrical Experimenter?* We don't know. We can only guess. Sometimes we guess right, often wrong.

Will you help us by telling us what appeals most to you? Only by means of your aid can we bring this magazine to perfection. It is easy for us to give you what you like most, *but you MUST tell us.* We will take a vote among our readers and carefully classify results. We promise to be guided wholly by this vote, and will publish the results in the August issue.

Fill in the spaces below by placing a figure in the square alongside of the subject in the order of your preference. Thus, if you like the wireless department best, place Fig. 1 alongside of it. If your second choice is "Patents" place a figure 2 alongside of it. If "Among the Amateurs" is your third choice placed a 3 alongside of it, and so all the way down. This will guide us absolutely. And be sure to give us your *frank* criticism. When the blank is filled out cut it out and paste it on a postal.

It costs but one cent to vote, and you will get just what you like most. So before you turn the page fill out the blank, NOW!

## VOTING BLANK

I give below, in the correct order of my preference, my choice on subjects in the *Electrical Experimenter:*

| | | |
|---|---|---|
| General Electric Articles | ☐ | CRITICISMS: |
| "Münchhausen" | ☐ | ..... |
| Electrical Experiments | ☐ | ..... |
| "The Constructor" | ☐ | ..... |
| "Wireless Department" | ☐ | ..... |
| "How to Make It" Department | ☐ | ..... |
| Electrical Magazine Review | ☐ | ..... |
| Latest Patents | ☐ | ..... |
| Among the Amateurs | ☐ | ..... |
| Question Box | ☐ | ..... |

I would like to see you print more.....

Name.....

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## NEW RADIO-ACTIVE ELEMENT.

Prof. Goehring, of the Physico-Chemical Institute at Karlsruhe, Germany, announces that he has discovered a new chemical element which he calls brevium.

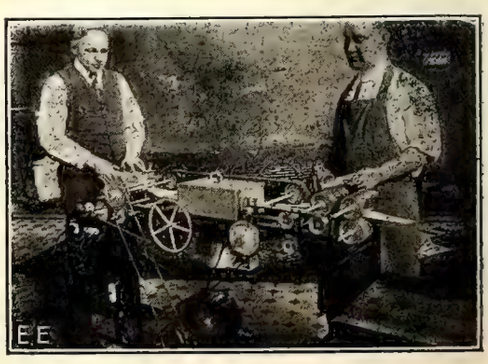
He states that brevium is radio-active and results from the disintegration of uranium.

Dr. Sinclair Tousey, expert in radio-activity, says of the discovery by Prof. Goehring:

"There are a whole series of dinintegration products of radium and thorium, and six or eight of these are already definitely known to chemists. Radium, of course, is the best known; another is mesothorium, which is of very great practical importance—more so than perhaps any of the others of the group, with the possible exception of radium. It is used in medicine, especially in Germany, for the same purposes as radium and to a much greater extent, for it is only half as expensive. Also it is only half as active. On general principles it is probable that the new element discovered by Prof. Goehring would have roughly similar qualities to those of the other elements of the group. Inasmuch as the fact that a large number of such derivatives exist was known the isolation from time to time of any one of them is a thing not altogether unexpected in the scientific world."

## ELECTRICALLY DRIVEN ENVELOPE SEALER.

A new electrically driven machine which will seal several thousand envelopes an hour has recently been perfected in the Government Laboratories at Washington, D. C. This machine is shown in the illustration, and the operator at the left is feeding a batch of envelopes into the machine. These pass through the various rotating friction drums; as will be perceived, and in the course of their journey, pass through a vapor bath, created by a small vaporizing tank placed at the center of the machine. This vaporizer is operated by a small alcohol torch applied underneath. An electrical heater can be used.




**Uncle Sam's New Envelope Sealer.**

This device is open to the public, as far as making duplicates is concerned, and anyone may enjoy the benefits from this particular invention without any cost for patent rights.

# Electrical Fishes.

PERHAPS in all life there is nothing more interesting than electric animals, and yet but little of their real nature is generally known. Only in this new age of electrical wonders and

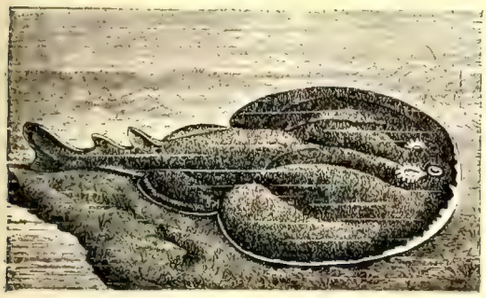


**Fig. 1. The Electric Fish Known as the "Torpedo."**

miracles have we been brought face to face understandingly with the marvels of nature; to-day we know that every living animal evolves in various ways enormous amounts of electricity. There are both animals and insects that are remarkable electric batteries, strikingly like the electric appliances which we use. Cats give forth sparks of electricity when their fur is rubbed in the dark, and even man himself is a walking electric dynamo.

The most curious of electric animals is a certain fish which discharges shocks at will to defend itself. It is a huge flat fish, known as the "torpedo" (Fig. 1), belonging to the sun tribe, and frequenting the waters of the Mediterranean Sea. Sailors and fishermen tell many strange and weird stories of this sea-electrician. Frequently they claim to have found their arms bound by the invisible and mysterious current of electricity sent up the line by the fish below. Until recent years these phenomena were regarded by seafarers with superstitious awe, Ages before this fish's electrical powers were understood, certain Roman physicians kept large aquariums of them and patients were allowed to touch the "torpedo" and receive shocks, as a means of curing certain diseases.

There are two other electrical fish, each belonging to the fresh water regions of the tropical countries, which rival the "torpedo" in their electrical powers. These are the *Gymnotus electricus* (Fig. 2) and the *Silurus electricus* (see Fig. 3). In each of these fish electricity is developed by specific organs, which are not unlike the form or shape of a voltaic battery.

The electrical organ is used by these fishes in order to catch or kill the prey; also to ward off attacks from other fishes.

In Fig. 4 we show the electrical organ of one of these fishes; this is to be distinguished into two separate parts, namely, the nerves and the special organ into which these nerves branch out. This organ is

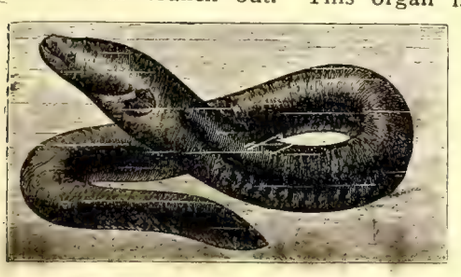


**Fig. 2. Electric Eel, "Gymnotus Electricus."**

always built up of a great many discs or plates, which, however, vary in size and shape as to the different fishes. These discs or plates are really a curious form of muscle.

At (a) Fig. 4 will be seen the frontal brain from which branch out the nerves (r). Then follows the central brain and after this the small brain and finally the large lobes (b), which form the electrical central, the so-called *"lobus electricus."* From this a great many sets of nerves branch out, which are then distributed over the electrical organ (cc). This takes up much of both sides of the brain, as well as a part of the back. It also occupies a large amount of the forward section of the body of the animal.

The discs or plates mentioned above lay on top of each other and form an organ which can be best compared with a voltaic pile. It is probably very similar in certain respects to Galvani's first battery. In Fig. 5 we show one of these organs, (a) being the nerves as they branch out over the discs.

In Fig. 6 is shown a large magnification of one of these discs. A part of the nerves go to the inside of the disc, then branch out and end in a grain-like mucous mass in the form of small sphere-like cells (bb). Another part of the nerves then branch out into the protecting tissue (cd).

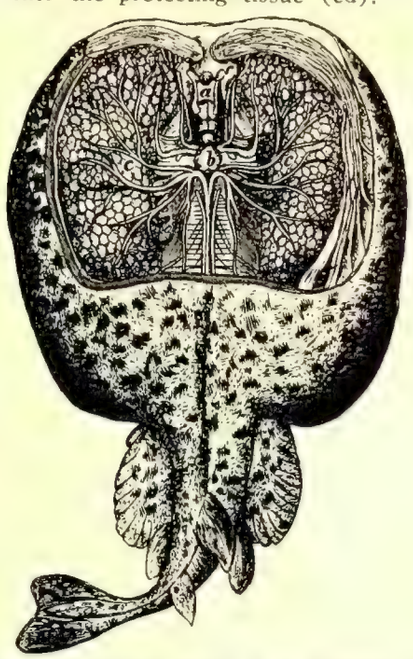


**Fig. 4. The Frontal Brain of an Electric Fish.**

The electrical nature of the shocks of these fishes has been studied experimentally by Walsh as early as 1773. He has shown that, for instance, the *"silurus electricus,"* as shown in Fig. 3, is only capable of giving electrical shocks when the back as well as the belly are touched together. In this case the human body forms a path through which the electrical current passes. Of course, one can get a very strong electrical shock even if one does not actually touch the fish in the above manner with the hands. For instance, a wet rope or any other object which is a good conductor when touched by the hand will transmit the electrical energy when the fish touches it. For this reason it is also possible to obtain a powerful shock directly through the water.

The first shock of one of these fishes is very powerful and sometimes is strong enough to paralyze or even kill a horse. The second shock, however, is already weak, and after a few shocks the fish is not able to give out any more electric energy. It takes quite a time for the fish to accumulate and again charge the cells electrically.

The most formidable of these electricians is the *Gymnotus electricus* of South America. History relates that many fords and rivers have been abandoned because of these strange shock-givers which infest them. The early Indians, who lived near to nature, took advantage of their knowl-

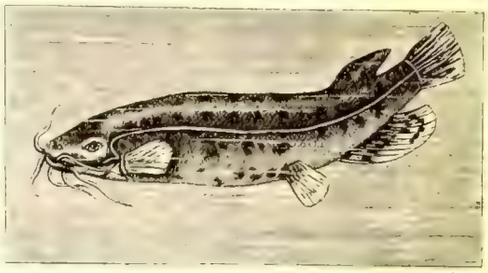


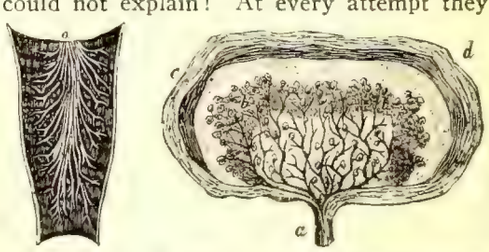
**Fig. 3. Another Specimen of Shock-giving Fish Called the "Silurus Electricus."**

edge concerning these creatures and caught wild horses by driving them into infested ponds.

The streams near Caracas, South America, are overrun with the much-dreaded *Gymnotus,* and the natives use a strange method of capturing both horses and fish. They call this method "intoxication by means of horses." When a herd of wild horses is driven into one of these fish ponds, the fish are awakened from their slumbers and ascend from the bottom of the water, darting here and there. Their great yellow, snake-like bodies are hurled against the terrified horses, which, with staring eyes and distended nostrils, fiercely paw and kick as they endeavor to plunge their half-paralyzed bodies out of the water. Some of the horses are immediately killed by the electrical shocks of these fish, but the others may be easily captured by the native who is usually mounted on a horse trained for the work. This form of horse catching is very popular.

These powerful fish show a fiendish ingenuity in using their electrical powers. They seem to know the most vulnerable points of attack, for they glide under the horse, give the fatal touch near the heart which acts like lightning, and glide away to safety. This they repeat until their electric force is exhausted, when they float to the surface of the water and may easily be caught.

A few years ago, when electricity was not so well understood, and experiments with electric animals practically new, an electric craze went over the civilized world. Electric fish were much in demand; their curative powers were extolled, and hospitals and sanitariums kept them for their patients. Even enterprising showmen and street fakers took advantage of the craze; everywhere were seen aquariums tagged with signs offering big rewards for the one who could lift the fish out of the water. This offer was accepted by numerous strong men, but they never succeeded in removing the fish from the tank, why, they could not explain! At every attempt they



**At Left, Fig. 5, Shows Nerves Branching Out Over Disc Organ. Right, Fig. 6, Enlarged View of Sphere-Like Cells of Electrical Fish.**

tumbled over from the shock, while the curious crowds jeered and laughed.

As to the power of these electric shocks

(*Continued on page* 50.)

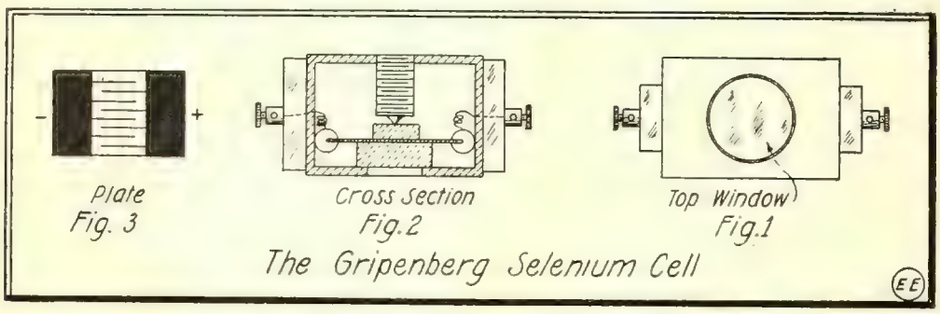
## THE GRIPENBERG SELENIUM CELL.

By Samuel Wein.

Of the various forms in which selenium cells have been constructed, the most efficient is that made by William Sebastine Gripenberg.

The cell consists of a small screw-press by means of which a very thin plate of selenium is pressed against the electrodes.

The electrodes are made as follows: A glass plate is covered with a thin layer of gold. By means of a sharp tool, the film of gold is removed in a way as shown in Fig. 3. The electrodes form a fine grating whose bars are at a distance of about 0.35 mm. from each other, and there are 12 to 21 bars per mm.




The properties of the cell depend mainly upon the thickness of the selenium, as the action of light is limited to an extremely thin layer of the exposed surface (calculated by Marc to be about 1/500,000th inch thick). Thin plates of selenium generally give high resistance, high sensibility, and rapid recovery after exposure to light.

Mr. Gripenberg discovered that selenium, when molten between a cold and a very hot glass plate, strongly adhered to the latter, after the annealing (crystallization). It is thus possible to cover a thin glass plate (1/250th inch thick) with an exceedingly fine film of selenium (between 0.01 and 0.0001 mm.) having a very good contact with the electrodes.

The most important point, however, is that a thin layer of amorphous selenium (less than 0.01 mm.) cannot be converted into metallic selenium by heating, on account of its contraction or decrease in volume (5 to 8 per cent.) and collects in drops like mercury; as soon as a temperature of about 90 degrees C. is attained. This contraction is prevented by applying the selenium with a coat of a suitable lacquer (celluloid Zapoulach).

The conductivity of such cells in strong light may be 1,000 times greater than in the dark. Resistances corresponding to the above thicknesses are the following: 10,000 ohms dark, 2,000 ohms light; 100,000,000 ohms dark, 100,000 ohms light.

Cells constructed according to this method are very reliable and show remarkable constancy, and are well protected from outside influences; moreover, a selenium plate that for some reason has lost its efficiency can be easily replaced by another piece, at small cost. Antimonite having the same photo-electric property as selenium can also be used in the cell.

## LOST! ONE WIRELESS MESSAGE.

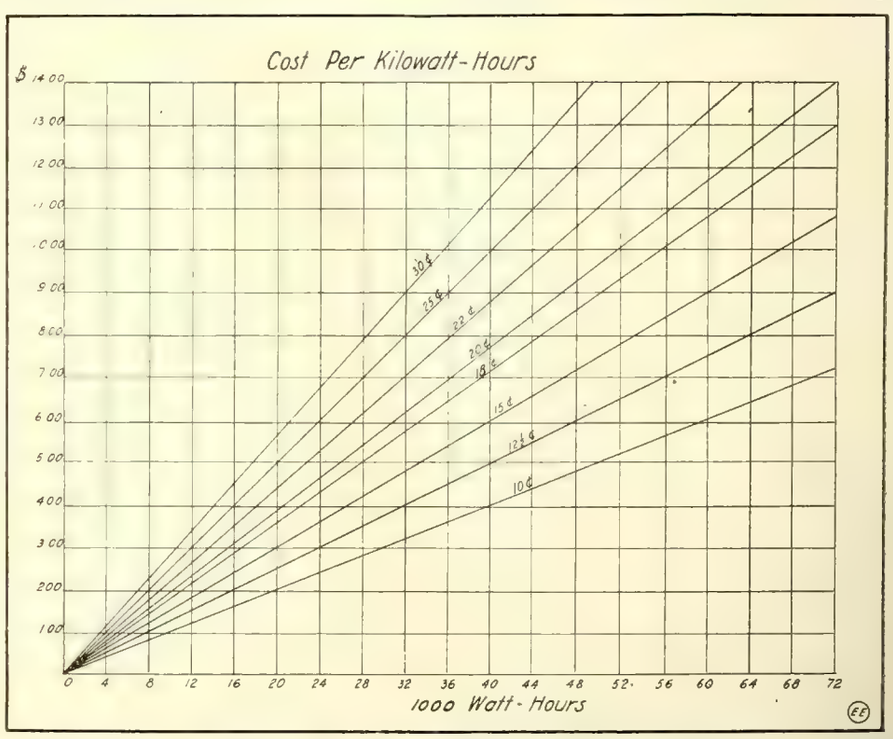
A complaint of the Berliner Handelsgesellschaft recently stated that a wireless message sent by them to the United States from Eilevese, Germany, via the Tuckerton transatlantic radio station was lost somewhere between the sending point and its destination; New York City. [*Perhaps one of the English cruisers, parading up and down our coast, nabbed it. What?*]

## MORE WIRELESS TIME SETS.

A wireless outfit has been installed by Jeweler Prescott, of Oakdale, Calif., for receiving the correct time directly to his office. At noon each day the correct time is sent by wireless all over the country, and anyone having an instrument installed can take the correct time when the signal comes at noon. A set of wireless instruments can be installed in an isolated quarter, where telegraph or telephone lines do not reach, and can receive and send messages and receive the correct time.

## HOW TO COMPUTE YOUR ELECTRIC BILL.

Those who use electric current from central station service will find the curves here given convenient in computing the total cost of energy in dollars for various kilowatt-hours. Electrical energy is sold by the kilowatt-hour, usually, which represents about 1 1/3 horsepower used for 1 hour, or ten 100-watt Tungsten lamp load for 1 hour, or a couple of 500-watt electric sad irons for 1 hour, etc. Ordinary 16 C. P. 110-volt carbon filament lamps consume about 55 watts an hour or 10 of them would take .55 K. W. H. To find the K. W. H., knowing the total watts used, divide by 1,000 (1,000 watts equal 1 kilowatt), and multiply by the number of hours the current is used.




**To Figure Directly Your Electric Bill; Look Upward on Line Corresponding to Thousands of Watt-Hours Used, Until it Strikes the Slanting Line Marked with Your Rate. From This Intersection Look Over to the Left and Read Total Bill in Dollars.**

In the curve chart here given, the base line represents K. W. H. For instance, suppose you use 1,000 watts for 40 hours. Then you have 1,000 divided by 1,000, equals 1 kilowatt and this times 40 gives 40 kilowatt-hours. Suppose your K. W. H. rate is 10 cents. Then, looking up the vertical line until the 10 cent diagonal is reached and following the horizontal intersecting line over to the left, the total cost is seen to be $4.00. Fractional amounts are readily judged or a new chart is readily made by anyone interested on a piece of cross-section paper.

## ELECTRICAL FISHES.

(*Concluded.*)

—numerous experiments have proven that they greatly vary in degree; a bird will topple over dead if it chances to light just above a "torpedo." And this is not astonishing when we remember that men are completely paralyzed when spearing these creatures.

The eminent Dutch surgeon, Gramund, found that the effect "produced by the fish corresponded exactly with that produced by the Leyden jar, with this difference; that we see no glitter on its body, however strong the blow it gives; for, if the fish is large, those who touch it are struck down."

Humboldt was one of the first to examine carefully the batteries of electric fish. One tremendous monster was captured near Calabazo, which, by means of its shocks, killed a mule and seriously injured the rider. The huge fish was finally hooked, but the line becoming wet the fish communicated such shocks to the captors that they were powerless to move and were held as though by electric wires. They finally succeeded in bringing the monster to the shore and found that it was twenty-two feet in length. It had practically the same relative size throughout its entire length, with a broad head, compressed tail and the under side of the body lined with four natural electric batteries, two on each side. The strange plates and the batteries were vertical, not horizontal, as in the "torpedo," and each was supplied by nerves from the vertical branches of about four hundred spinal nerves. Such monsters, armed as they are, might well prove dangerous, a touch of their tails frequently bringing sudden death.

There are unquestionably numerous other electric animals and insects yet undiscovered. Perhaps the time is not far distant when the presence of electricity in all forms of life will be an accepted and proven theory.

# How to Build a Telegraphone

**By Samuel Cohen**

THE telegraphone is an electro-magnetic instrument which records the human voice, music or other sounds on a fine moving steel wire, and these sounds are reproduced as perfectly as in a telephone, if not more so.

The invention of this instrument is due to the researches of Valdemar Poulsen, the Danish Edison, who, while experimenting with the telephone about 1900, discovered a new principle in electro-magnetism which solved the difficult problem of recording and reproducing sound. This principle is the localization of magnetism on a movable steel wire while passing through two small electro-magnets which are excited by some outside source.

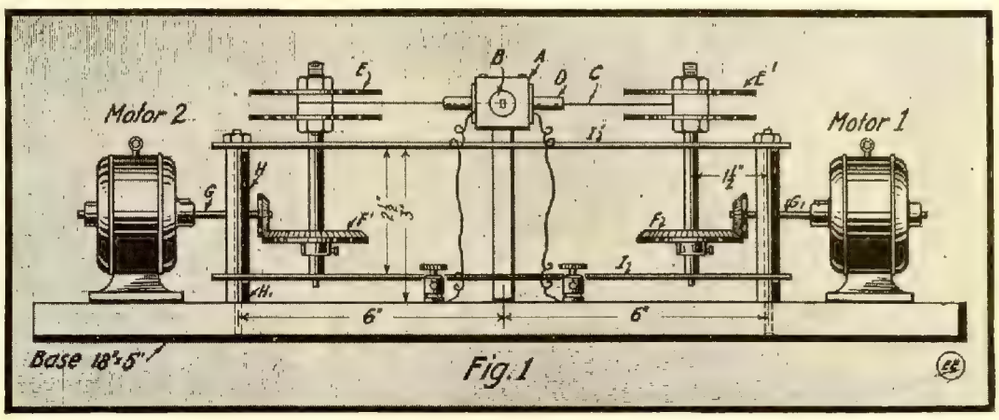
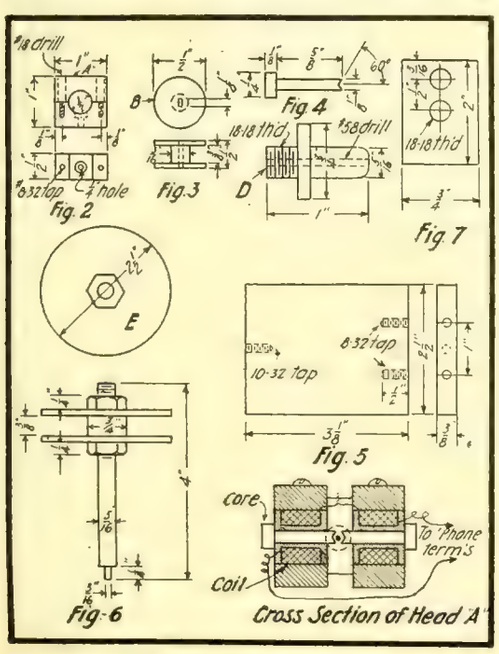



**Fig. 1. The Telegraphone Which Can Record Telephonic or Telegraphic Signals on an Iron Wire.**

The telegraphone here described was built by the writer especially for the purpose of recording radio-telegraphic and telephonic messages. The writer presents herewith a photograph of the finished telegraphone, and Fig. 1 is the drawing of all the principal parts and their relation to one another in the final assembly.

The details for constructing the individual parts of the telegraphone are given in the accompanying drawings. These do not require much description. By looking at Fig. 1 two aluminum plates I I¹, which constitute the supporting frame of the instrument, are fastened to a wooden base 18x5x¾ inches. These two plates are separated by brass washers H H¹ as shown.

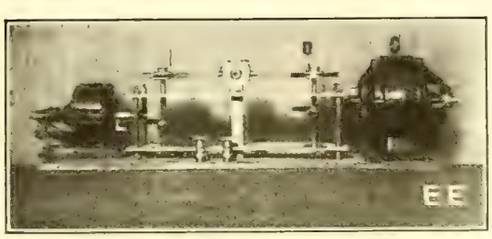
The talking and receiving "head" A consists of two small electro-magnets B B




**Details of Telegraphone.**

supported by a suitable frame made of brass shown in Fig. 2. The two bobbins B B are made of hard rubber as shown in Fig. 3. These bobbins are then wound with 200 feet of No. 40 B. & S. gauge copper wire on each; care should be taken that the wire is wound evenly. The iron core, Fig. 4, is now to be made from soft sheet iron No. 18 gauge. The talking head supporter is made of brass or fiber, and details are shown in Fig. 5.

The two wire reels E E¹ are easily made from two aluminum discs 2½ inches in diameter and separated by a brass washer ¾ inch in diameter. These discs are held firmly on the shaft, Fig. 6, by two ¾-inch



**Photograph of Completed Telegraphone.**

brass nuts. A 2-inch beveled brass gear is now placed on each shaft as shown in Fig. 1. The wire guides D D are now made, and details of their construction are shown in Fig. 7. After each separate part has been completed, assemble them as shown in Fig. 1. Two small motors 1 and 2 are connected to the beveled gears F F¹ by two small miter pinions as shown. Now procure about 200 feet of 32 gage steel piano wire and wind it on one spool. One end of the wire is now passed through the guides D D and attached to the other reel.

The two electro-magnets B B are joined in series and connected to the receiving set in substitute for the usual telephone receivers. One of the motors is now started, and if there is any message in the ether the recording coils will record every sound on the moving steel wire. To reproduce these sounds it is necessary to unreel the wire in the opposite direction. This is done by running the opposite motor and unmeshing No. 1 motor gear. Now disconnect the telegraphone from the receiving set and connect a pair of phones to the talking head, and by listening in the receivers the operator will receive every signal that has been sent. High-speed messages may thus be copied on this instrument and reproduced very slowly, so that the unprofessional operator may read the same high-speed signals slowly just by running the motor slowly, etc. The ordinary speed of the wire is 10 feet per second.

This telegraphone may be used excellently in connection with the ordinary line telephone. Telephone conversations and secret messages can be copied on this instrument just by connecting this instrument to the line wire in place of the usual receiver. It is hoped that this valuable instrument may be particularly advantageous to the experimenter who desires an instrument for recording radio signals.

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The trans-Atlantic wireless stations in Germany have been heard clearly at the University of North Dakota, a distance of 4,300 miles.

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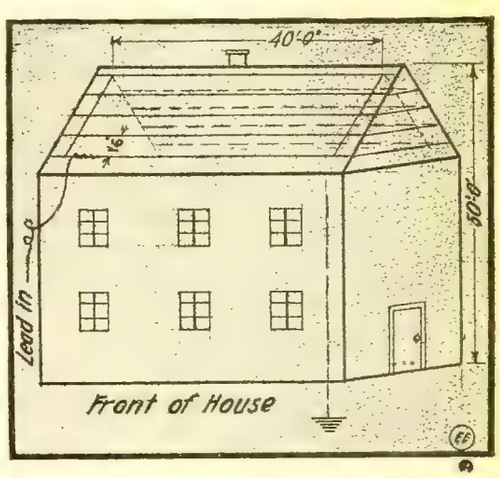
## SUCCESSFUL INDOOR AERIAL.

One of our readers, Raymond Schlegel, of Pittsburgh, Pa., has successfully used the form of indoor wireless aerial illustrated herewith. This arrangement consists of placing wire under the roof in the attic of the building and on both sides of the slanting roof structure. The wires are spaced about one and one-half feet apart and consist of No. 14 conductor. The highest wire in the aerial is about 50 feet above the ground. The length of the strands is 40 feet, there being nine wires in all.

They are all joined together at either end and, of course, insulators are placed in each strand. Mr. Schlegel has been able to pick up the wireless time signals from Arlington, Va., twice a day, at noon and in the evening at 10 o'clock, using a Ga-




**Indoor Type Wireless Aerial. Efficient Under Wood, Slate or Tile Roofs.**

lena or Silicon detector, with regular head 'phones, etc.

He states also that he can still read the time signals with this outfit with the head 'phones removed several inches from the ears. Metal-covered roofs are not as good in this case as tile covering, which obtains in this instance.

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Have you voted? Do it now. See page 48.

## WIRELESS ON THE MOTOR BOAT.

Now that the motor boat and yachting season is in full swing it is undoubtedly of great interest to many owners of such

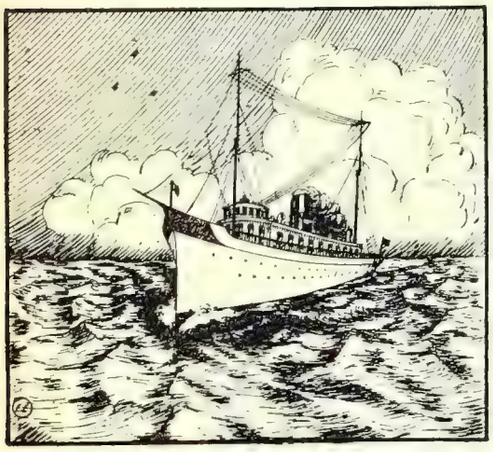


Fig. 1. Showing the Aerial on a Motor-Boat or Yacht.

craft to have a small wireless sending and receiving set on board in case of emergency, etc. It is surprising what an efficient outfit can be installed at very small cost nowadays.

The sketches and diagrams given herewith show how the set is best installed and assembled, on a hardwood or other switchboard preferably, so as to take up the minimum space possible.

Figure 1 shows the aerial arrangement for small motor boats, and it is best to have the foremast about 20 feet high at least. The small auxiliary rear mast should be nearly as high, if possible. The form of aerial shown has proven very efficient for such installations, and it may comprise four strands of phosphor-bronze cable spaced about 3 to 4 feet apart. The length of span between the spreaders will, of course, be governed by the size of the boat.

Regular antenna insulators should be used, of course, in each strand where they are fastened to the spreaders, and the lower section of the aerial should be tapered, so that all of the four or more strands are joined together to a No. 8 or larger copper conductor, passing through the lead-in tube or insulator L (see Fig. 2) placed in the roof or side wall of the cabin, as shown. It is well to place some sealing compound P over the end of the insulator L to keep water, etc., from running in during rainstorms, etc.

Regarding the radio set itself, this may be mounted exactly as the diagrams indicate and the transmitting set may comprise, for ordinary requirements, a storage battery of 6 to 8 volts, 3 to 4-inch spark coil S, Leyden jar or glass plate condenser C, tuning helix H, hot wire radiation ammeter W and throw-over aerial switch A, also key and spark gap M.

The receiving equipment may very well be selected to comprise a few high-grade and efficient instruments; such as a good-grade loose coupler B, mineral or other detector D, fixed condenser F, variable condenser K, pair of 2,000 or 3,000 ohm head phones T, together with necessary wire for connecting the various instruments.

The ground connection for such a station may be made in some cases through a No. 4 insulated copper wire G leading to the engine frame and the ground, thus established through the propeller shaft. In some cases the ground connection is made by connecting the wire G to a copper plate about 2 feet square, fastened on the outside of the hull, so that it is in thorough contact with the water.

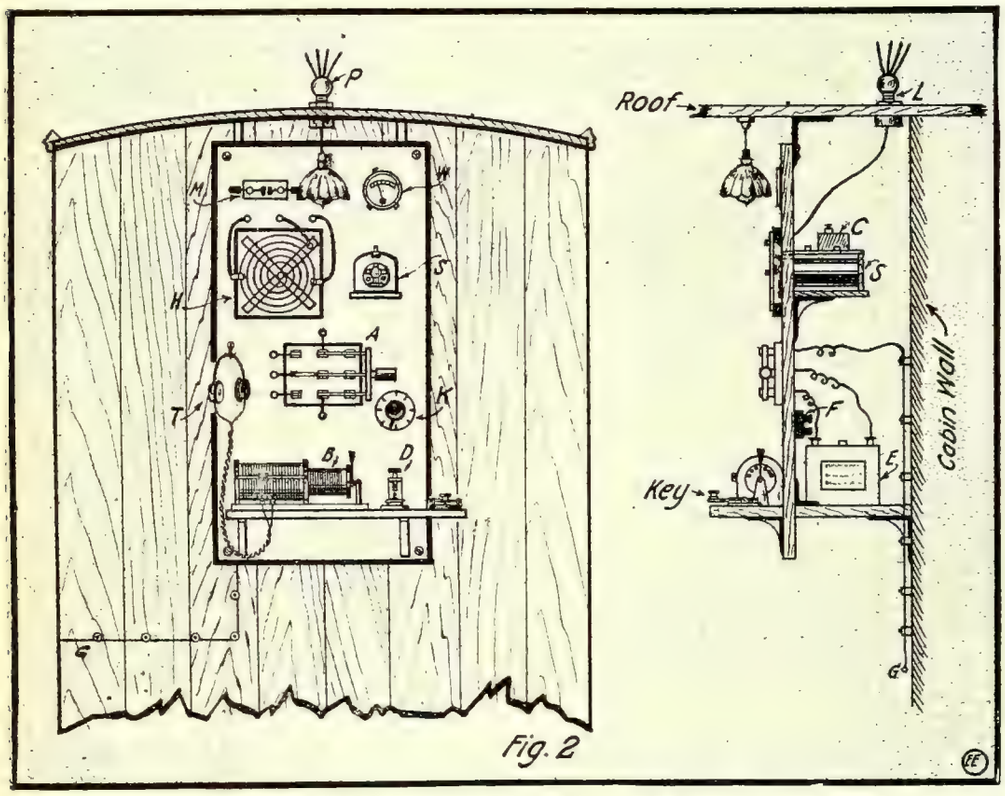



Fig. 2. Arrangement of Radio Apparatus in Cabin of Boat. Panel Style.

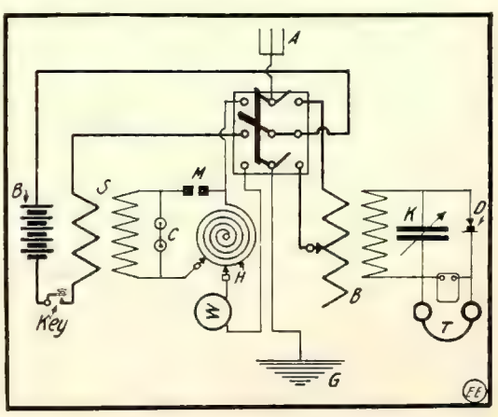
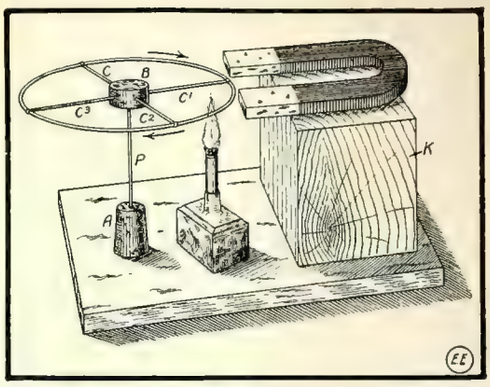



Fig. 3. Wiring Diagram of Boat Wireless Set.

At Fig. 3 is shown plainly the connections for this wireless outfit, and in transmitting the aerial switch A is closed in the proper manner and the signals are sent out, of course, in the telegraph code, which is usually now the Continental, by means of the telegraph key mounted on the front shelf of the switchboard. In tuning the receiving instruments the switches or sliders on the loose coupler are adjusted until the signals are received loudest. Also the variable condenser, if used, is moved until best results are obtained. It is best to use a regular buzzer test for adjusting the detector to its best condition. Further description is hardly necessary in this direction, as complete instructions and blue prints are invariably furnished with such an apparatus when purchased.

## AN INTERESTING THERMO-ELECTRIC MOTOR.

The following brief description of a very simple thermo-electric motor will make it easy to build for the ordinary experiment-




Novel Motor Works by Heat and Magnetism.

er. The rim of the wheel is made from fairly thick iron wire and held by a cork B. The spokes C, $C^1$, $C^2$, $C^3$, are made of copper wire. The wheel is supported by a pin P and cork A. This cork is next glued to the base. A large steel horseshoe magnet is next supported on a block of wood K, near the wheel as shown. A small alcohol lamp is now placed under the rim of the wheel. As soon as that portion of the wheel becomes hot the wheel will begin to turn slowly, the heated portion turning away from the magnet—the reason being that, while iron is attracted by a magnet at ordinary temperatures, when the temperature is increased beyond a certain limit this partially ceases to be the case. But the cooler part is still subject to magnetic attraction, and the wheel is consequently kept on turning so as to bring such cooled portions in closer proximity to the poles of the steel magnet. The rim of the wheel should be not less than 3 to 4 inches in diameter.

## HOW TO AMALGAMATE ZINC.

The chief difficulty one experiences in amalgamating zinc battery rods is in rubbing the metallic mercury into the surface. This difficulty can be obviated by using the following method: At first clean thoroughly the zinc from dirt and grease by dipping the zinc into a concentrated hydrochloric acid solution. The zinc is now placed for 10 minutes in a solution of bichloride of mercury. The bichloride of mercury will decompose and metallic mercury will unite with the zinc.

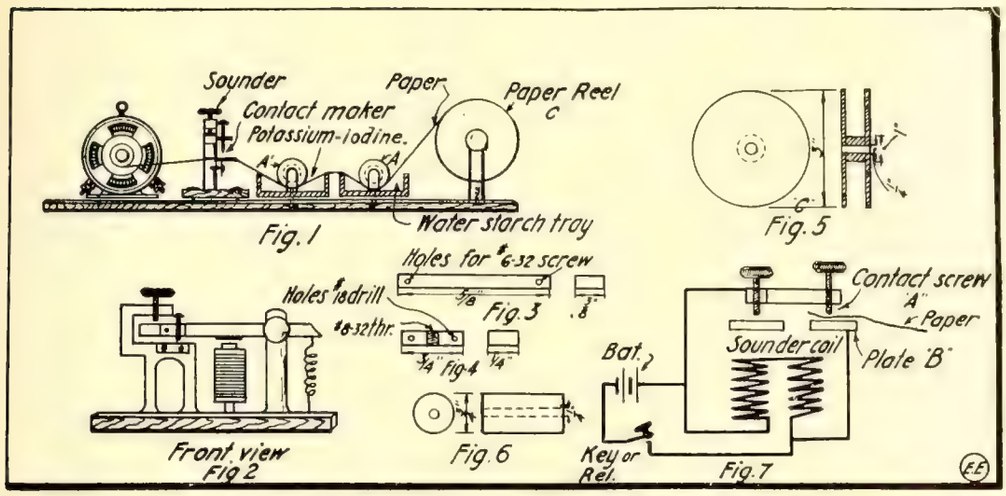
(Note.—Care should be taken in handling the bichloride of mercury as this salt is very corrosive on flesh and clothes. It is also very poisonous.)

## AN INKLESS TELEGRAPH RECORDER.

**By Samuel Cohen.**

A UNIQUE, but practical, inkless recorder can be made by anyone, which will copy "code" without using a pen or pencil.

The following material will be needed




**Ingenious Telegraphic Recorder Using Neither Pen Nor Pencil.**

in constructing this inkless recorder: A small battery motor, one telegraph set, four binding posts, two feet of ¼x¼-inch brass rod, two rubber rollers, two small trays, one ounce of potassium iodide, four ounces of common starch, one rheostat, one S. P. S. T. switch; three inches of ¾-inch rubber rod, 1x1-foot brass sheeting 24 gauge.

First construct the contact point shown in Fig. 4, which consists of a rubber strip ¾x¼ inch and drilled as shown. This piece is then fastened to the lever of the sounder shown in Fig. 2. Then make the contact bed, which is made of ⅜x¼-inch brass rod; dimensions are shown in Fig. 3. After it has been made, it is then fitted on the sounder bracket (Fig. 2).

Two reels are then made of No. 18 gauge brass sheeting (Fig. 5). One reel is mounted on motor, and the other reel is mounted on a brass bracket ½x⅛x4 inches.

Two rubber rollers AA¹ (Fig. 1) are then made. These rollers are made of hard rubber (Fig. 6) and are mounted on brass standards 1½x½x½ inches.

Two 4x5 photograph developing trays are then mounted and clamped to the base as shown in Fig 1.

In the first tray A make a starch solution as follows: Dissolve four ounces of common potatoe starch, and in tray B dissolve four ounces of potassium iodide crystals in full tray of water.

After all the parts are made, arrange each part as shown in Fig. 1. Connect the contact point A and bed plate B as shown in Fig. 7. A rehostat and one S. P. S. T. switch is connected in series with the motor in order to regulate the speed of copying.

In operating this recorder properly, it is necessary that the speed of the motor is constant, or else the printing on the paper tape will not be regular.

By regulating the speed of the motor and the current through the contact point by a second rheostat telegraph code has been copied as fast as 50 words per minute. The drawings are self-explanatory.

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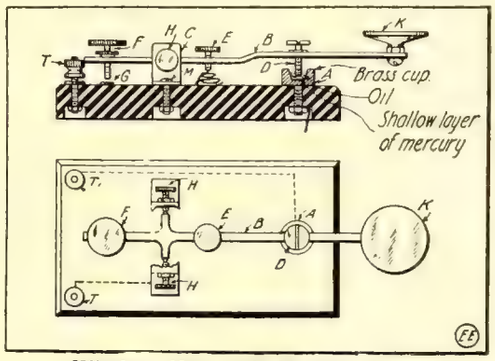
Remember: Storage batteries have to be charged from direct current. Use a rectifier on alternating current.

## A MERCURY BREAK WIRELESS KEY.

A good key for wireless transmitters is a necessity. It must be adjustable, the contacts of good size to carry heavy currents and, lastly, easily worked. The following key embodies all these good points:

The base, which is made of hard wood, may easily be procured. The size is left to the reader, that of the writer's being 6 x 3¼ x 1 in. Two holes are bored for T and $T_1$, the terminals. Some good, stiff brass strip is obtained and bent, as shown in figure, first drilling four holes, two on each side $M_1$ $M_1$, H and $H_1$; the screws




**Wireless Key with Mercury Break.**

M $M_1$ being to attach it to base and H and $H_1$ for pivots for the lever B. This lever, while of standard shape, is of heavier brass and longer than usual. Three holes are tapped in it for adjusting screws F, E and D. G is simply a metal rest for F. The function of F and E is apparent.

We now come to the contact device, A. This consists either of a carbon cup made from a dry-cell carbon or a brass cup, the latter is preferred. A *very* little mercury is placed in cup and covered with a little oil (olive oil will do, or even cylinder oil). The reason for the shallow mercury layer is that the tendency to "lag" will be reduced to a minimum. Then D is screwed down in the oil, so that it hardly touches the mercury. Then A is connected by a wire to $T_1$. For a better connection to other terminal, the spring at E may also be connected to it. K is a hard-rubber knob.

After a little practise, the adjustment may be improved so that no "lag" is detected and good satisfaction is enjoyed.

Contributed by H. C. GRAHAM.

## A NEW TYPE SENDING HELIX.

A finely adjustable helix is an instrument that should be in every amateur's station, and here is one that does away with clips and loose wires.

A base is made, preferably of oak or mahogany, 24" long, 12" wide and 1" thick. Two end pieces, either round or square, should be made of the same material. If round they should be 8" in diameter, and if square, 8" by 8". In the center of each end piece a hole should be bored of ample size to admit the axle, which in turn should be threaded and provided with nuts to hold the end pieces in place.

Some No. 6 B. & S. aluminum helix wire should be procured and wound into a spiral 8" in diameter and 12" long with 1" space between turns; 3 spacing bars can be placed on frame as seen to support the wire if necessary.

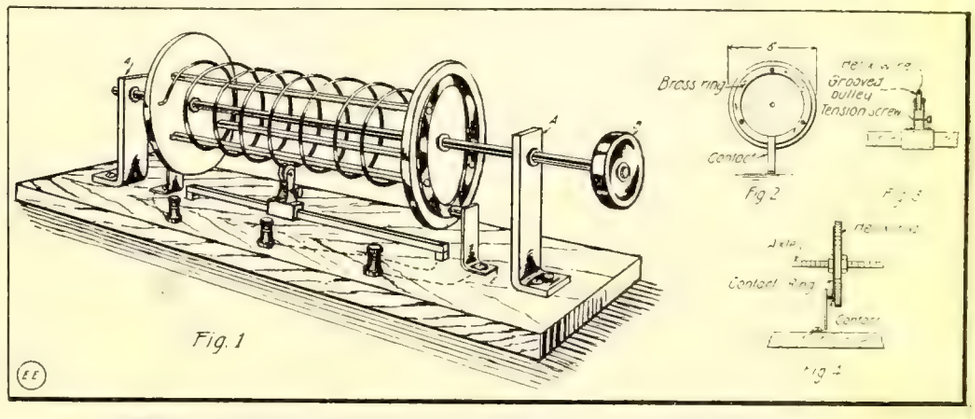
Two rings are cut from sheet brass 8" O. D. by 6" I. D. by 1/16" thick. These are to be fastened on the end frame pieces by flat-headed screws passed thru countersunk holes. Get a battery bolt and file the end (the one with the screw driver notch in it) down flat, which is to be run thru the ring and end piece and fastened to the coil on the other side. The other end of the coil should be fastened to the other end piece in like manner.

The slider is made of ¼"x¼" I. D. brass tubing. Two pieces of spring brass or phosphor bronze are soldered to the top, one of which should be threaded and provided with a screw, and the other should have a hole bored in it of sufficient size to let the screw slip thru and screw into the other spring. The screw is used to regulate the grooved pulley action, as evident from Fig. 3. The slider rod is to be mounted about ¼" above the base and should be ¼" square and about 13" long.

In Fig. 1, C is a brass upright to keep the axle from slipping back and forth thru the bearings, A and A. B is a hard rubber knob fastened on the end of the axle to rotate coil.

I think the drawings will explain the rest, and the dimensions may vary to suit each builder.

By J. H. ALDEN.




**Efficient Design of Radio Helix Enabling Any Part of Coil to Be Used.**

# Spectacular Discharges and Large Tesla Coils

To the uninitiated in electrical science there is probably no more entrancing and awe-inspiring effect to be seen than the spectacular display produced by

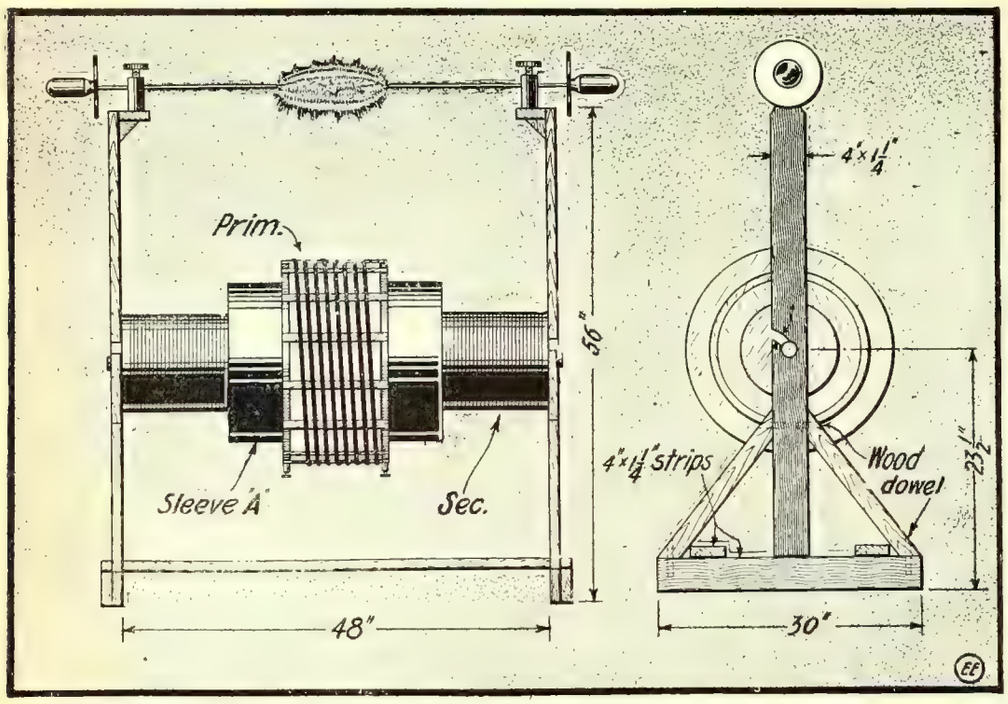



Fig. 2A. Appearance of Complete Tesla Coil for Use on 1 K. W. Transformer.

the Tesla transformer. There are many acts traveling over the various theatre circuits which make use of the Tesla high frequency apparatus, and herein we will describe briefly how to construct one of these large 36" spark Tesla coils, together with necessary exciting transformer, auxiliary condenser and also spark gap.

Referring to Fig. 1, the complete closed core type high voltage 1 kilowatt transformer is shown at A. As seen, the secondary and primary coils are wound each on one of the longer legs of the sheet iron core. The completed transformer may very well be mounted in a metal or lead lined wooden case, as shown at B, which is afterward filled with transit oil. The transformer is mounted on a couple of wood blocks, as indicated, placed inside the case.

Referring to details on this transformer, which is designed for operation on 110 volt, 60 cycle A. C. circuit, at a current of 9 to

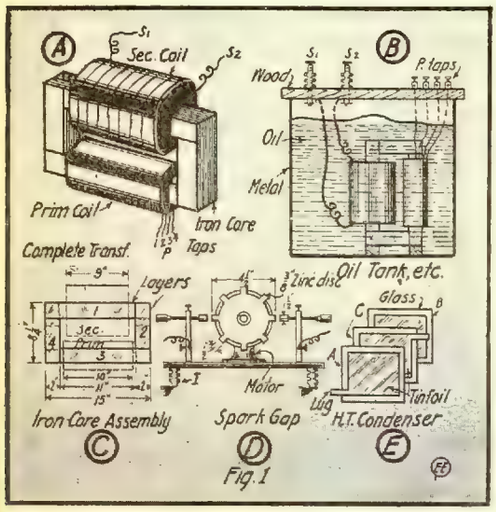



Fig. 1. Details of Step-Up Exciting Transformer, Condenser, and Spark Gap.

10 amperes maximum, the dimensions and method of assembling the alternate layers of sheet iron strips are shown at C, Fig. 1. As seen, the individual strips, such as Nos. 1, 2, 3, 4, are staggered or lapped over the joints between the strips on the layer under it, as indicated by the dotted lines. In this way a solid core is easily built up and at either end suitable clamps made from a couple of pieces of iron or brass, with a couple of bolts, should be used to clamp it firmly together.

The transformer coils are best wound on wooden forms. The primary is 10" long and has on it 12 pounds, or 344 turns, of No. 10 B. & S. D. C. C. wire, with taps from the 250, 300, 344, and 1st turn for secondary voltage adjustment. Wrap several layers oiled linen around the primary core before slipping on the coil. Details on winding are given in any handbook on transformers.

The secondary comprises 11 pounds, or 50,000 turns, of No. 33 B. & S. enameled magnet wire, wound in 24 wax-impregnated pies or sections, each ¼" thick. Secondary then gives about 20,000 volts, with 250 primary turns in circuit. An adjustable choke coil like the primary in construction helps out the control nicely. The secondary core leg is to have 10-12 layers of oiled linen on it before the secondary pies are slipped over it.

The spark gap used for this 1 kilowatt high frequency generating outfit is probably best made of the rotary type, as shown at D, Fig. 1. This gap is composed of a zinc disc, about 4½" in diameter, having 8 to 10 projecting plugs cut on same as shown, to provide sparking points, as the disc is rotated by a suitable motor. This may be an ordinary fan motor. Two stationary spark electrodes are provided, as indicated, and the whole arrangement is best mounted on a marble or glass base. A piece of hard wood thoroughly boiled in hot wax may be utilized for the base.

Regarding the high voltage glass plate condenser for this outfit its arrangement is shown at E, Fig. 1. About .042 M. F. capacity is required in this condenser when the transformer delivers 20,000 volts, 60 cycle A. C., at the secondary terminals. If ordinary glass is used ⅛" thick, about 46 such plates measuring 12x14" are necessary, both sides of the plates being coated with heavy tinfoil 8x10", cut with a projecting connection lug as shown at E. When the condenser has been prepared it may be mounted in a cabinet suitably built and then filled with parafine or transit oil. The glass plates are placed one on top of the other in the final assembly, and there is only, of course, 1 tinfoil leaf between each plate. Every other tinfoil leaf connects to a common terminal, and in this way all the glass plates connected are charged and discharged when in circuit.

The dimensions for the large Tesla coil

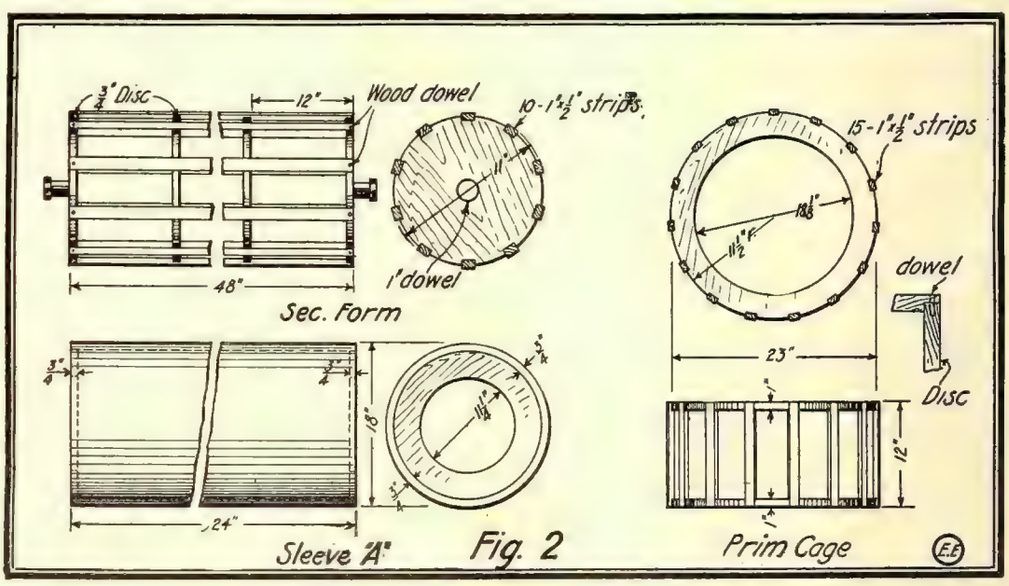



Fig. 2. Details of Large 36-Inch Spark Tesla Coil Parts.

to be used with this outfit, capable of producing 30 to 36" high frequency sparks when all of the apparatus is properly tuned and adjusted, are given at Figs. 2 and 2A. This special large size, extra high voltage, high frequency air core transformer, is built at small cost and consists of a primary and secondary coil as usual, as well as an insulating sleeve A, ¾" thick, made of shellacked paper or oiled linen.

The wooden framework for supporting the coils is indicated quite clearly in the drawing, and all of the wood parts are best boiled in hot wax. No metal parts, excepting the wire on the coils, should be used in constructing this transformer. The wood joints are readily held together securely by drilling ¼" holes and driving in same wooden dowel pins.

The secondary cage is made up of four

wood discs with 10 wood strips doweled fast to them as shown. The primary form is made in the form of a cage also, as indicated, of two wood rings and 15 wood strips, also held in place by wood dowels.

The primary of this large Telsa coil can be wound with 10 turns of No. 4 B. & S.

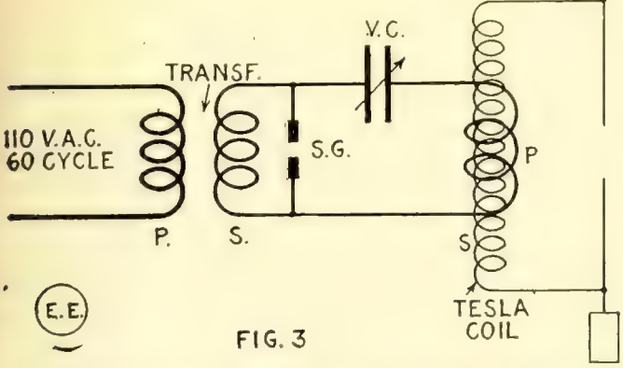



FIG. 3

**Hook-Up of Large Tesla Coil and Exciting Transformer.**

bare copper, brass or aluminum wire spaced 1" between turns and the ends of the coil brought out to two binding posts. A substantial helix clip should be provided for one terminal of the primary circuit for adjustment. The secondary coil is wound with one layer No. 24 B. & S. enameled magnet wire, and each turn should be spaced apart the thickness of the wire by winding on a lathe, etc. Before winding the secondary coil the wooden cage may be covered with several layers of stiff paper or a layer of Bristol board. The layers of wire should be well shellacked.

The connections for the complete outfit are shown at Fig. 3, where V. C. is the high voltage condenser arranged to be adjustable, and S. G. is the rotary spark gap. P. & S. are the primaries and secondaries, respectively, of the transformers. Tune the set for best results by altering the condenser plates on multiple and gap speed, the exciting transformer, and the Tesla primary turns in circuit. Use No. 6 wire or, better, copper ribbon for the high frequency connections.

## FLUORESCENT WRITING.

If we dissolve some sulphate of quinine in water and then draw a design or write some motto or sentence on a piece of white paper with the solution and allow it to dry the drawing or design will be absolutely invisible. But if this same piece of paper be illuminated by the light of a Geissler or vacuum tube then the design or writing will at once appear as if written or drawn with a beautiful blue ink.

## MARKING TOOLS WITH ACID.

The *American Machinist* recommends the following etching fluid for marking tools: Mix one part of muriatic acid, one of nitric and four parts of water. The tool is coated with wax and the design is then scratched in.

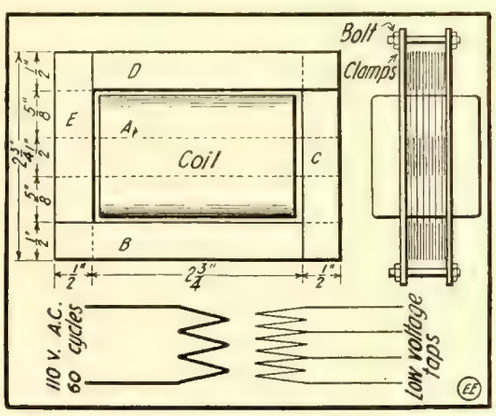
## CONSTRUCTING A BELL-RINGING TRANSFORMER.

A small transformer, that can be used to operate bells, motors, etc., when supplied with 110 volts A. C., can be made very cheaply and saves the battery bill.

First construct the core, which consists of sheet iron strips. Cut up a pile of strips ½x3¼ inches for the middle leg A, and ¾-inch high when compressed. In a like manner cut up a pile with the dimensions ½x 3¾x¾ inches high, for two outside legs B and D. For the parts E and C cut up one pile only, ½x2¾x¾ inches high. The middle core A should be wound at first with five or six layers of heavy paper, and place over this a layer of friction tape. Now wind on one ounce of No. 34 enameled wire and wind it on the central portion as evenly as possible. The primary winding is then covered with several alternate layers of tape and shellacked paper.

The secondary winding consists of three sizes of insulated magnet wire, first, 100 turns of No. 22; second, 100 turns of No. 2, and third, 150 turns of No. 26. The ends of each winding are connected together, the end of the first to the beginning of the second, etc. This arrangement allows a final choice of three secondary voltages. The whole core should be arranged as shown in drawing. The core is held together by two clamps, one on each end. These clamps are made of strips of iron ⅛-inch thick, and are cut ½x3½ inches, four pieces being needed for the two clamps. One-eighth inch from each end a 3-16-inch hole is drilled. The core should be clamped in a vise and tightened up by the bolts on each end.

The transformer thus made may now be




**How a Bell-Ringing A. C. Transformer Is Made.**

mounted in a suitable metal box filled with wax, and proper connections made as shown in diagram.

## THE "GEAR" ROTARY SPARK GAP.

**By S. Kruse.**

The McCreary-Moore gear-gap is not as well known as its merits deserve. In the original design developed by Robert Moore an 80-tooth 16-pitch (5-inch diameter) brass gear, from which every second tooth has been removed, is mounted on the shaft of a "polishing head" B. The fiber or oak bar C carries two ½-inch brass rods or two large binding posts bushed up with washers, which in turn support the fixed electrodes of the form D.

It is of the utmost importance that the fixed electrodes be of the form indicated and that they be mounted on the frame and not on the base, to prevent vibration from the motor causing the electrodes to move.

The gear must be very carefully trued by mounting it on a shaft and then laying the shaft on a pair of straight-edges (rulers, saw-backs, etc.), and filing the rim of the heavy side till the gear will stay in any position.

The solid construction, good balance and comparatively low speed insure a wheel that is quiet and true-running to a hairline, while the shape of the parts gives a slow approach, yet a very sharp break.

The result is a tone equaled only by a 500-cycle synchronous gap.

If a lower note is desired a Marconi tone may be obtained by removing 60 teeth and leaving 20. If preferred, a bicycle sprocket may be used, but it is hard to get perfect running unless a metal bushing is used.

The gap *must* be set as close as it will run—never over 1-20 inch—and will operate on as little as 100 watts. If more than 300 watts are employed a series-fixed or quenched gap may be employed to advantage.

When used as shown, direct-connected to a 12-inch induction fan motor, this gap is absolutely trouble-proof. A 60-cycle motor of this type runs at 1,750 r.p.m. on light loads, which gives (about) 1,200 and 600 sparks for the 40-tooth and 20-tooth wheels.

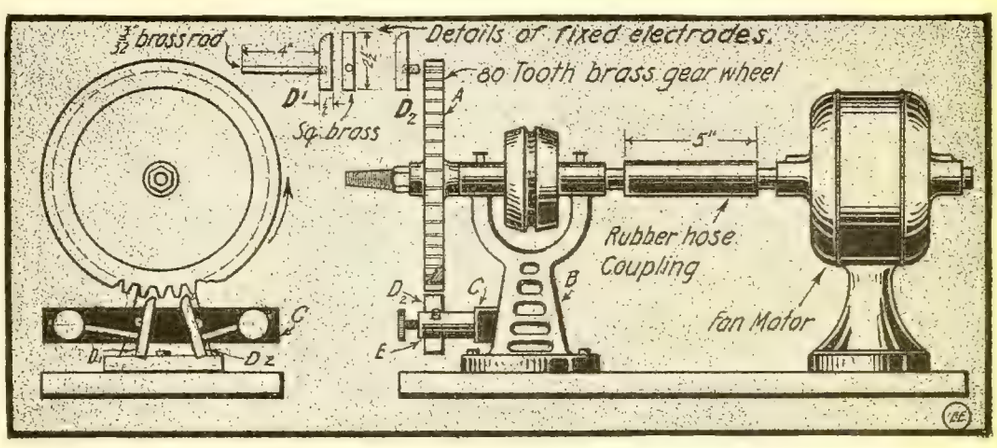
Where there is little "QRM" the 600 rate is better, but with much interference the high tone "cuts through" better.

In conclusion I will say that the gear-gap is universal in this region and that we have ranges which, for the power used, are second to none. My call is 9 LQ.

## SUN SPOTS UPSET WIRELESS.

Unusual sun spot activity was reported recently by astronomers at Christian Brothers College, St. Louis, Mo. The wireless instruments at the college were greatly disturbed, and this is attributed to the sun spots. Nine spots were visible.

Litigation between the Marconi Wireless Telegraph Co. and the National Electric Signaling Co. has been settled by a license agreement by which the Marconi company secures the use of 171 Fessenden patents and in return grants the use of two basic tuning patents of Marconi and Lodge.




**Unique Spark Gap Made from Gear Wheel Having Alternate Teeth Removed.**

Uncle Sam's newest dreadnought is to be driven by powerful electric motors. Steam turbines drive the dynamos.

*If you are not a subscriber don't fail to see page 38. If you don't we both lose.*

## WRINKLES — RECIPES — FORMULAS

**Edited by S. GERNSBACK**

Under this heading we will publish every month useful information in Mechanics, Electricity and Chemistry. We shall be pleased, of course, to have our readers send us any recipes, formulas, wrinkles, new ideas, etc., useful to the experimenter, which will be duly paid for, upon publication, if acceptable.

### FORMULA No. 10.
### Paints.

*Proportions of Colors for Ordinary Paints:*

*White*—100 parts of *White Lead.*

*Black*—100 parts of *Lampblack.*

*Green*—25 parts of *White Lead* and 75 parts of *Verdigris.*

*Stone*—99 parts of *White Lead* and 1 part *Burnt Umber.*

*Lead*—98 parts of *White Lead* and 2 parts of *Lampblack.*

*Red*—50 parts of *Red Lead* and 50 parts of *Red Ocher.*

*Chocolate*—4 parts of *Lampblack* and 95 parts of *Spanish Brown.*

Add the required quantity of *Raw Linseed Oil, Boiled Linseed Oil, Turpentine* and *Drier.*

For 20 lb. of paint take 2 lb. of *Raw Linseed Oil,* 2 lb. of *Boiled Linseed Oil,* ½ lb. of *Turpentine,* 1-10 lb. of *Drier.*

The proportions given must only be taken as an approximate guide when the materials are of good quality.

*Anti-Corrosive Paint.*—Take equal parts (by weight) of *Whiting* and *White Lead,* with half the quantity of *Fine Sand* or *Gravel,* with a sufficient quantity of *Color.* This paint can be used as a water color, but it is more durable to dry it in cakes or powder after mixing, and then use it as an oil paint by grinding it again in linseed oil. The proportions are: 12 parts of *Raw Linseed Oil;* 1 part *Boiled Linseed Oil* and 3 parts of *Sulphate of Lime* well mixed; 1 gal. of this prepared oil is used to 7 lb. of the powder.

*Luminous Paint.*—Mix together 40 parts of *Copal Varnish* (containing neither lead nor manganese, which would destroy the phosphorescence); 6 parts of prepared *Barium Sulphate;* 6 parts of prepared *Calcium Carbonate;* 12 parts of prepared *White Zinc Sulphite;* 36 parts of good *Luminous Calcium Sulphite* in a proper vessel to an emulsion and then grind it very fine in a color mill.

*Phosphorescent Paint.*—Heat *Strontium Thisulphate* for 15 minutes over a good Bunsen gas lamp, and then for 5 minutes over a blast lamp. Mix with pure *Melted Paraffin* for use as a paint for clock dials, etc., and expose for a time to sunlight.

*Stencil Paint.*—Take *Shellac,* 2 oz.; *Borax,* 2 oz.; *Water,* 25 oz.; *Gum Arabic,* 2 oz.; *Lampblack,* sufficient quantity. Boil the borax and shellac in water till they are dissolved; when the solution has become cold, complete 25 oz. with water and add lampblack enough to bring the preparation to a suitable consistence.

*Innoxious Color for Painting Toys.*—Mix 6 parts of *White Fine Chalk,* 3 parts of *Calcined Magnesia* (thoroughly calcined). Add a few drops of indigo solution. Oil, turpentine, driers as for any other paint.

*White Paint for Metallic Surfaces.*—Oil paints used on metallic surfaces exposed to heat frequently turn yellow. If, instead of oil, *Sodium Silicate* be used, no change of color will be noticed.

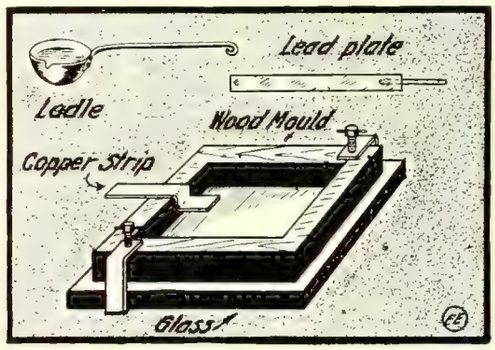
*Marine Paint.*—For metals in salt water: 44 parts of *Red Lead,* 24 parts of *Quicksilver,* 5½ parts of *Thick Turpentine.* Mix to proper consistency with boiled linseed oil. Grind the turpentine and quicksilver together. Then grind this mixture with the red lead and add the linseed oil. Use as little oil as is necessary to make the paint lay on well. To make the Marine Paint adhere firmly, use first a coat of *Oxide of Iron.*

## A REMARKABLE PRIMARY BATTERY.

The primary cell with which we are all familiar has one bad feature, viz., polarization. To overcome this trouble, due to using metal electrodes such as zinc, which allow the electrolyte solution to carry zinc salts to the surface of the opposite electrode, of copper, say, one of the most ingenious improvements in a long time has been made by E. Bellini.

His method is quite radical in primary battery design, and instead of employing zinc for the negative electrode he has utilized a cast-lead plate having a slight amount of mercury in it.

In Mr. Bellini's battery the negative electrode is formed of an amalgam of lead, formed by pouring mercury into the molten lead. A suitable proportion is to take one part by weight of mercury and nine parts by weight of lead. The positive electrode is a carbon sheet. The electrolyte is a mixture of sulphuric and nitric acids. A suitable proportion for the solution has been found by mixing a litre of water with 80 cubic cm. of sulphuric acid




**Showing Mould for Casting New Mercury and Lead Battery Plates.**

of 66 deg. Baumé and 120 cubic cm. of nitric acid of 36 deg. Baumé. The E. M. F. of this battery will be found to be 1.25 volts. During the working of the battery a white, flocculent and heavy substance falls from the negative electrode to the bottom of the cell. This substance is formed of lead sulphate, mercurous sulphate and of little globules of metallic mercury. Gas is given off from the positive electrode, and this is found to consist of the products of decomposition of nitric acid.

In the illustration is depicted a simple scheme for casting these special lead amalgam plates. A wood block is mortised out as seen and is backed up by a slate or other smooth plate. Clamps or weights hold the two together. A little fire clay or putty may be placed around the outside seam of the slate and wood. For connection a copper strip is bent as shown and placed in the mold so as to be cast in the plate. The molten lead amalgam is poured into the mould and soon becomes solidified. The slight amount of mercury is added to the hot lead before pouring. The plate can be about ⅛ to $\frac{3}{16}$ inch thick.

The battery used for the author's test in finding the rate of discharge was formed of four positive plates, placed alternately with three negative or lead amalgam plates. The total active surface of negative electrode was 900 square cm., and of the positive 1,230 square cm. The mean distance between the electrodes was 2 cm. The total amount of electrolyte was 2.6 litres. The internal resistance was 0.022 ohm for a rate of discharge of 5 amperes. The capacity was found to be 112.5 ampere-hours. At the end of the 24 hours there was added 450 cubic cm. of water, 96 cubic cm. of sulphuric acid of 66 degrees B, and 192 cubic cm. of nitric acid of 36 deg. B.; the test was then continued for a further period of 14 hours. The capacity was 63 ampere-hours. The same amount of electrolyte was then added again, and the battery was then discharged for 27 hours, with an interval of rest of 11 hours in the middle of the test, the capacity being in the last case 115 ampere-hours.

The consumption of the amalgam on open circuit is very small, and to all intents and purposes nil, provided the surface of the electrode is clean and free from any foreign substance which might give rise to local couples. The consumption of the amalgam on closed circuit is about 5 grammes per ampere-hour. This battery seems to have considerable merit indeed.

## BOOK REVIEW.

"Oxy-Acetylene Welding and Cutting." By Calvin F. Swingle, M.E. 200 pages. 76 illustrations. Size 4½x6¾ inches. Published by Frederick J. Drake & Co., Chicago, Ill. $1.00. Cloth.

A timely treatise written in easily understood fashion on the operation and care of acetylene generating plants; also the removal of carbon by the oxygen process. The illustrations are very clear, making the matter easily interpreted to the layman. The subject starts off with welding, oxygen and its properties, acetylene and acetylene generators, etc.

Practical instructions are cited throughout the book in regard to the best way to burn steel beams in half, cutting off pipes, boilers, and other details of interest to the oxy-acetylene operator and lay reader alike.

"Drake's Telephone Handbook." By David Penn Moreton, B.S., E.E., Associate Professor of Electrical Engineering, Armour Institute of Technology. Pocket size, 4½x7 inches. Cloth covers. 285 pages, 161 illustrations. Price, $1. Frederick J. Drake & Co., Chicago, Ill.

A new book on practical telephone matters by Professor Moreton, and written in his easily understood style, suitably illustrated. The first part of the book takes up the fundamentals of electricity rather briefly, but this is made up for by the excellent and complete digest of up-to-date telephone systems. One chapter deals with the physics of sound as related to telephone matters, and then follows magnet systems, common battery systems, the construction of telephone lines, with span, tables, etc., while the book finishes with a complete index to all ordinary telephone line and instrument troubles.

The section on common battery systems is modern and covers the Bell and Western Electric circuits, which are clearly explained, so that anyone can soon grasp the principles involved in making a connection through a central battery exchange. Moreover, all of the standard apparatus is mentioned in diagrams, such as P. B. X. exchanges, with W. E. Co. equipment, including type number, etc., as 10 ohm 118-A.P. relays, 8-P retard coil, 87-A relay, et cetera. Undoubtedly this book, especially at the price, will have a large sale among those interested in the actual working details of modern telephone systems.

# WIRELESS DEPARTMENT

## The Fessenden Radio Station at Brooklyn, N. Y.

The National Electric Signaling Co., exploiting the wireless patents and inventions of Prof. Reginald A. Fessenden, formerly special scientist in wireless research for the United States Government, and now the inventor of the new submarine signal, has a very fine radio plant at Brooklyn.

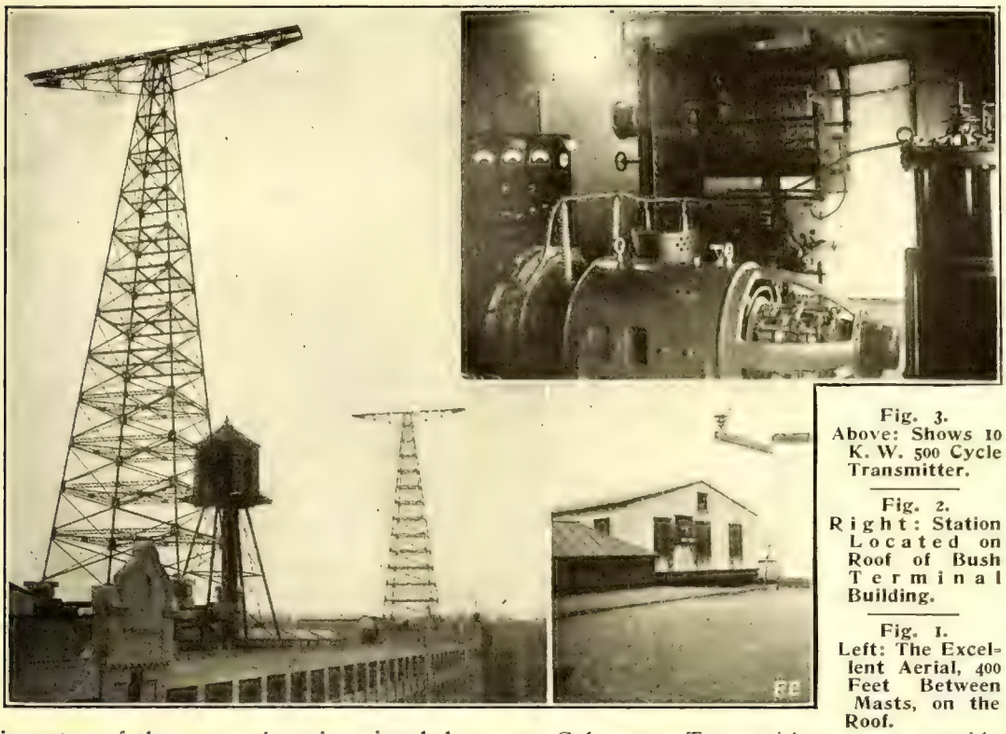


Fig. 3. Above: Shows 10 K. W. 500 Cycle Transmitter.

Fig. 2. Right: Station Located on Roof of Bush Terminal Building.

Fig. 1. Left: The Excellent Aerial, 400 Feet Between Masts, on the Roof.

The photographs here shown illustrate the mighty steel aerial towers, also station and apparatus of its plant located at the Bush Terminal, Brooklyn, N. Y. On the roof of the six-story concrete building, in which the plant is located, two gigantic latticed steel masts are erected, which are seen in the photograph.

These towers (Fig. 1) are substantially constructed to withstand a heavy gale. The aerial span is about 400 feet and the height of each tower is 150 feet. The towers are insulated from their supporting surface on the roof by a concrete foundation and conical porcelain foot insulators about 2 feet high. The cross-arms, or spreaders, at the top of the towers, are about 40 feet long and support 15 phosphor bronze aerial cables.

The lead-in (Fig. 2) is brought to a lightning grounding switch outside of the station and another wire is led into the station, where it is connected to a regular antenna switch.

The station has a high frequency alternator, which is capable of delivering an alternating current with a frequency of 200,000 cycles per second. This high frequency alternator is driven at an enormous velocity, the speed often being as high at 30,000 revolutions per minute. It is driven by a De Laval steam turbine, in which the shaft runs at 25,000 to 30,000 R. P. M. The alternator delivers an output of 2 K. W.

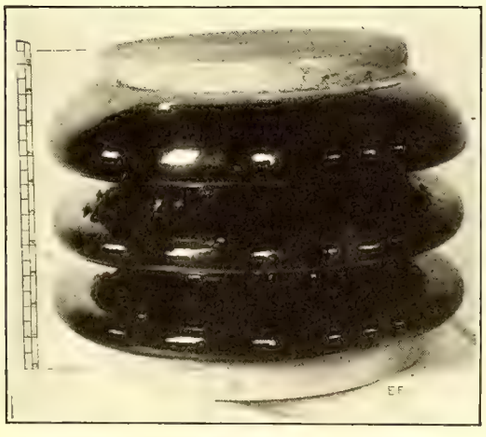
The regular 10 K. W. transmitting apparatus is shown in photograph (Fig. 3). This generator is seen in the foreground. The condensers are located at the extreme right in the photo and are of the compressed air type. The oscillation transformer is located on the rear of the transmitting panel and is discerned at the center of the photograph.

The inductance of the oscillation transformer is regulated by means of a handle in front of the panel below one of the meters as perceived. Remarkable results have been obtained with this 500 cycle set. Signals have been transmitted in daylight to Galveston, Tex., without any trouble, which is quite remarkable from the standpoint of efficiency.

The receiving set consists of the standard Fessenden type heterodyne receiver, operating upon the "beat" principle, thus realizing an amplification value of considerable power. Messages are daily copied from Nauen, Germany; Honolulu, etc. Illustrations through courtesy of Mr. Kroger, chief engineer.

### MASSIVE INSULATORS FOR RADIO TOWERS.

The object of the extremely large porcelain supporting insulator here shown is to provide an insulated base for support and insulation of large electric conductors, and especially for currents at ultra-high voltages.



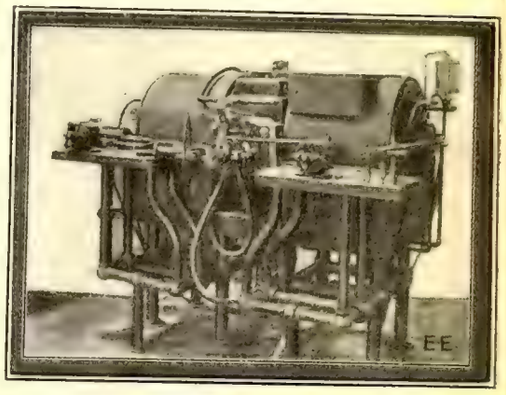
Massive Radio Mast Foot Insulator.

The insulators are manufactured by the wet process method, and stand 10½" high and are provided with corrugations or petticoats to increase the creepage distance and give a sheltered or dry surface under rain or storm conditions, the top and bottom of the insulator being provided with metal castings for mounting purposes. The total weight of the individual insulator is 120 lbs., including the metal parts. This design of insulator is capable of supporting a load of 500,000 lbs. and has an ultimate strength of 1,150,000 lbs.

This class of insulator is being used by the United States Government at its wireless stations at Panama, Balboa, San Diego, Cal., Honolulu in the Hawaiian Islands, Tutuila in the Samoan group, Guam and still another at Manila in the Philippines.

### OVER 4,000 MILES BY WIRELESS ARC.

The Poulsen arc rated at 100 kilowatts and the long-distance work accomplished by its use in signaling from San Francisco



Type of 100 K. W. Poulsen Arc Used to Signal 4,330 Miles.

to Honolulu and from Tuckerton to Honolulu (a distance of 4,330 miles) was featured in an excellent paper by L. C. Fuller, of the Federal Telegraph Co., at the April meeting of the American Institute of Electrical Engineers, New York.

It was a joint meeting of the American Institute of Electrical Engineers and the Institute of Radio Engineers. The Austin radio-transmission formula was checked in these tests by Mr. Fuller and fairly well substantiated for distances up to 4,330 miles, and this work should indeed be of great value to the radio profession engaged in designing long-distance apparatus. Wave lengths up to 11,000 meters were used. At 10,000 meters, using the 100-K.W. arc at Tuckerton, N. J., a daylight current of 5½ micro-amperes (5½-millionths of an ampere) was received The tikker was employed. The Goldschmidt alternator and the arc appear to give equally good results. Prof. Zenneck, of Germany, took part in the discussion, as well as several others of prominence in radio circles.

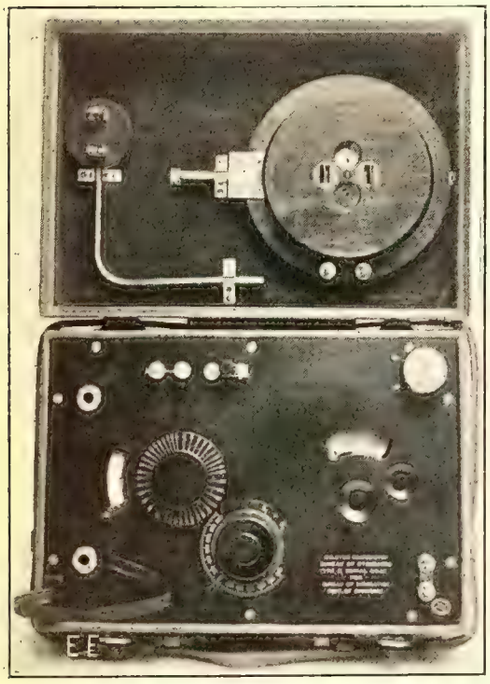
### INSTITUTE OF RADIO ENGINEERS MEETING.

The monthly meeting of the Institute was held on Wednesday evening, May 5, in Fayerweather Hall, Columbia University, New York city.

A paper by Mr. Benjamin Liebowitz was presented on "The Pupin Theory of Asymmetrical Rotors in Unidirectional Fields, with Special Reference to the Theory of the Goldschmidt Alternator." This paper dealt with the theory of the Goldschmidt alternator in particular, as developed by Prof. Pupin and contains some interesting conclusions.

## THE KOLSTER RADIO DECREMETER.

In radiotelegraphic circuits, the decay of the current surges is very important. Technically, it is known as the logarithmic



New Kolster Radio Decremeter.

decrement. This factor is stipulated by the United States statutes governing radio stations to be of 2/10 or less in magnitude. To furnish a quick and easily manipulated instrument for the purpose, the instrument shown was perfected by F. A. Kolster, of the Bureau of Standards.

It comprises interlocking condenser knobs, buzzer, hot wire meter, extra loading condenser, and exploring inductance coils, which latter may be seen resting in the lid of the cabinet. This instrument permits of all necessary wave measurements and is widely employed by the Government radio inspectors.

## H. A. MERKEL HAS RADIO STATION.

H. A. Merkel, a telegraph operator at Lyons Station, Pa., and living south of Fleetwood, is spending his spare time on his wireless telegraph. He has made extensive improvements to his apparatus, his aerial with his old arrangement having had considerable difficulty to read ships at sea and land stations over 600 miles away.

Mr. Merkel has now erected a mast 85 feet high and has lengthened the aerial to 130 feet, whereby he expects to have results that will liberally pay for his extra outlay of work and money. It has attracted hundreds of people in this vicinity, and the visitors find Mr. Merkel always ready to give them a thoro demonstration of his wireless.

## WIRELESS IN THE POLICE BARRACKS.

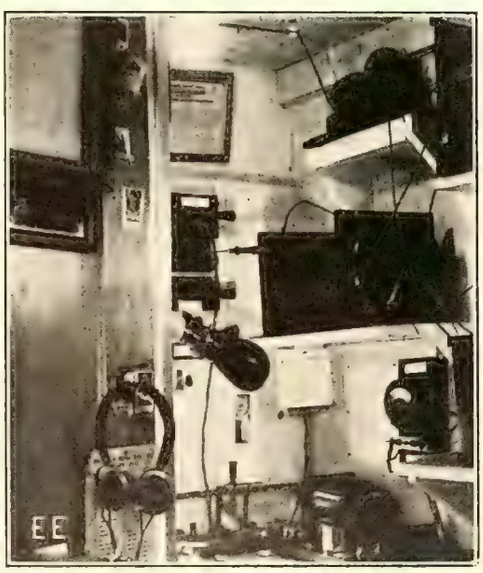
By Frank C. Perkins.

The accompanying illustration shows a novel wireless equipment in the Pennsylvania State Police Barracks at Pottsville, Pa. The sending apparatus consists of a Blitzen transformer, a condenser, oscillation transformer, rotary gap and hot wire ammeter arranged as shown in the photograph.

The receiving set includes what is termed a Radion receiving set, with loose coupler or transformer, Universal detector using Ferron crystal, fixed condenser, rotary variable condenser and two double telephone head sets with all wiring, including the Blitzen duplex loading coil and switch having a range of wave lengths covering all stations in the United States, all mounted on a mahogany base.

It may be stated that the aerial consists of four wires suspended in the air 75 to 100 feet, composed of phosphor bronze cable 50 feet long on top of the barracks, which is a three-story building. The lead wires from the aerial comes in separate to four double-throw single-pole switches. With proper manipulation of the switches the operator is able to receive and send on any desired wave length, the aerial being bridged at one end with wires one and two connected together. Two and three aerial leads connected by a single pole switch near aerial leads to instruments make it possible to use only two wires for receiving or four, or making the entire length of the wires one single wire by bridging the two other wires three and four at other end of aerial.

It is of interest to note that the ground wire is connected to the city water mains, besides several copper wires laid in the earth several feet deep under the aerial and all connected together. The joints are soldered throughout the entire plant. From this wireless plant all the commercial stations have been heard within a radius of several hundred miles, including Key West and the station at Guantanamo, Cuba, besides all the stations using from 175 meters up. This station is rated at one kilo-



Wireless Used by Police Department, at Pottsville, Pa.

watt and has a sending radius of about 75 to 100 miles. The operator is Cotesworth M. Jackson, of the Pennsylvania State police force.

## EFFECT OF THE EARTH IN RADIO TELEGRAPHY?

Prof. J. A. Fleming delivered an address on "The Function of the Earth in Radio Telegraphy" before the Wireless Society of London, recently.

It was an undoubted fact, he said, that the nature of the earth's surface exerted a most important effect on wireless transmission over it. In certain districts there was quite abnormal wave attenuation as, for instance, north and northeast of Newport, R. I. (U. S. A.), in the district where Dr. Austin's experiments were carried out between Brant Rock and the Cruiser "Birmingham."

Assuming standard physical properties, the depth of the "current skin" in the copper was about ¼ mm., but in iron it was only 1/50 mm., owing to the high permeability of this metal. By means of striking cymometer experiments, Prof. Fleming showed that while insulating coverings did not affect the damping produced by the magnetic properties of iron, galvanizing provided a skin of zinc thick enough to carry the high-frequency current without permitting the latter to reach the iron core. Galvanized iron wire was, therefore, permissible for aerials and for earth connections so long as the galvanizing remained continuous and uncorroded.

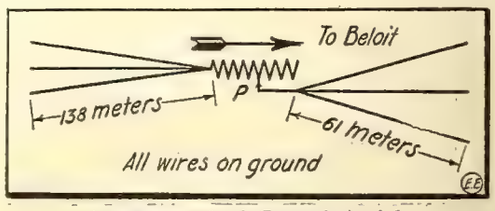
The materials of the earth's crust were conducting dielectrics, and the problem of the current penetration was complicated by the fact that conducted current and dielectric current had both to be taken into account. The conductivity of all dielectric materials, even if imperfect dielectrics, was much greater for alternating than for direct currents and was vastly greater still when carrying currents of radio-telegraphic frequency. There was, he said, a fertile field for research in measuring the conductivity and dielectric constants of the sea water and earth crust materials at radio-telegraphic frequencies, and particularly valuable results might be expected from really large scale experiments say, with huge electrodes one-quarter mile or so apart, which would give reliable averages for various kinds of soil under various conditions.

Prof. Fleming showed mathematically that refraction of electrostatic fields between air and earth or water produced a considerable horizontal component near the surface, thus producing a periodic displacement or wave in the earth's crust. To this prenomenon the speaker attributed the possibility of reception of time signals on such unorthodox aerials as bedsteads, bicycles and dustbins.

Though much yet remained to be learned, it was definitely established that good conductors prevented deep current penetration; that penetration and attenuation occurred apart from mere weakening by diffusion; that attenuation was greater for short than for long waves, and reached a maximum at certain values of permeability, resistance and dielectric constant; and that the curvature of the earth weakened the true space wave. At 3,000 to 6,000 miles, most of the received effect was probably due to bending by ionic refraction. Long-distance reception was complicated by many factors, and our earth was probably unique in being the only planet on which long-distance radio-telegraphy was possible.

## RADIO ANTENNAE ON GROUND.

A number of interesting tests on radio antennæ, composed of magnet wire resting on the ground are described in the *Electrical World* for March 20, 1915; Stations 600 kilometers away were clearly read.




Arrangement of Ground Aerial.

As a result of the experiments several facts stand out more or less clearly. In the first place, so far as we know, this is the first time in this country that electric waves have been successfully received over

commercial distances by using a single bare wire placed directly on the ground, say the authors. Further, it is apparent that a somewhat symmetrical multiple earth-wire system may be used for receiving in practical radio communication, without necessitating any increase in sending power over that employed when utilizing ordinary elevated antennae. It is also evident that such single or multiple earth-wire systems possess a directive effect, and that the elements which extend away from the transmitting station are the most important in this respect.

When used as an absorber, insulation of the wires apparently plays a very minor part. The best system evolved is shown in diagram; the multiple wires being joined to a loose coupler primary, P, situated 61 meters from the end, pointing toward Beloit, where the transmitter was located.

---

Magnetic coils for high frequency or wireless circuits contain no iron, as the current changes from positive to negative so fast, the iron cannot magnetize and demagnetize fast enough, giving rise to high hysteresis loss, as it is called. As high frequency alternators work at 100,000 cycles with iron cores, it is peculiar that inductance coils cannot have iron cores, and thus raise their efficiency.

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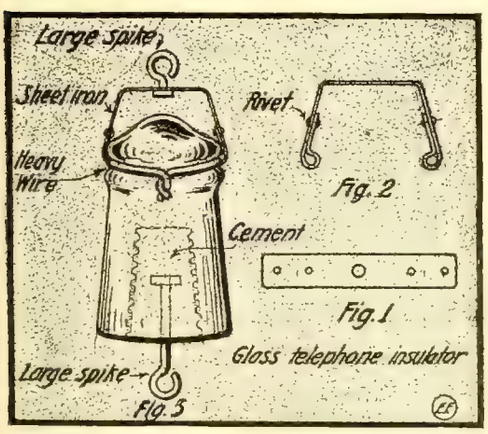
## HOW TO MAKE STRAIN INSULATORS.

Very good insulators for wireless aerials, etc., may be easily made from ordinary telephone insulators. First select good, sound insulators, and for each cut a sheet metal strap about one-inch wide and long enough so that after it is shaped (like shown in Fig. 2) the loops at each end will fit into the wire channel of the insulator. The loops at the end are first riveted, and then a hole is drilled in the center and a large spike inserted which is formed into a hook as shown. Hook the loops in the wire channel of the insulator and draw a heavy wire through the loops and around the insulator, then twist the ends quite tight. Make another hook from a large spike and with some cement imbed the head end of the spike in the hollow end of the insulator, as shown in Fig. 3 I am using these insulators in my wireless aerial with very good results. They will




**Strain Insulator Made of Glass and Cement.**

stand considerable strain and quite high voltage without breaking, besides being very cheaply constructed.

Contributed by
FRANK HAVERLAND, JR.

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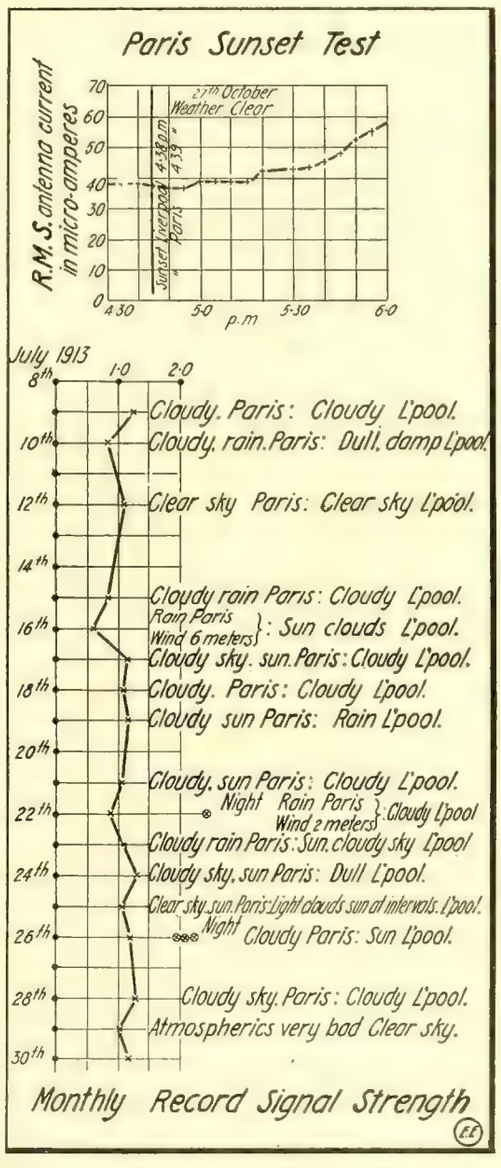
Do you know that "movie" machines consume very often as much as four to five horsepower?

## VARIATION OF STRENGTH OF RADIO SIGNALS.

In a paper by Prof. E. W. Marchant, D.Sc., in *The Electrician*, London, for Feb. 12, 1915, much interesting data, together with curves, is given on the conditions affecting the variations in strength of wireless signals, covering a considerable period.

One of the earliest observations in connection with wireless telegraphy was that it was possible to transmit over much longer distances by night than by day, and it has been a matter of discussion ever since as to what is the cause of that variation. Several observations have been made at the time of sunset, covering the "sunset effect," and part of the results are recorded in figure. The first point which deserves notice is that the increase in


Paris Sunset Test
R.M.S. antenna current in micro-amperes
27th October Weather Clear
Sunset Liverpool 4.38 p.m.
Paris 4.39 "
4.30
5.0
p.m
5.30
6.0
July 1913
8th Cloudy. Paris: Cloudy L'pool.
10th Cloudy, rain. Paris: Dull, damp L'pool.
12th Clear sky Paris: Clear sky L'pool.
14th Cloudy rain Paris: Cloudy L'pool.
16th Rain Paris / Wind 6 meters: Sun clouds L'pool.
Cloudy sky. sun. Paris: Cloudy L'pool.
18th Cloudy. Paris: Cloudy L'pool.
Cloudy sun Paris: Rain L'pool.
20th Cloudy. sun Paris: Cloudy L'pool.
22nd Night Rain Paris / Wind 2 meters: Cloudy L'pool
Cloudy rain Paris: Sun. cloudy sky L'pool
24th Cloudy sky. sun Paris: Dull L'pool.
Clear sky sun. Paris: Light clouds sun at intervals. L'pool.
26th Night Cloudy Paris: Sun L'pool.
28th Cloudy sky. Paris: Cloudy L'pool.
Atmospherics very bad Clear sky.
30th
Monthly Record Signal Strength

**Graphical Chart of Variation in Strength of Radio Signals.**

strength of the signal does not occur at the time of sunset, but some time afterward. This is what might have been expected if the state of ionization of the atmosphere is the controlling factor in determining the signal strength. The increase in signal strength occurs at almost the same time as daylight ceases, i. e., at the same time as the number of ions per cubic centimeter in the atmosphere would rapidly diminish.

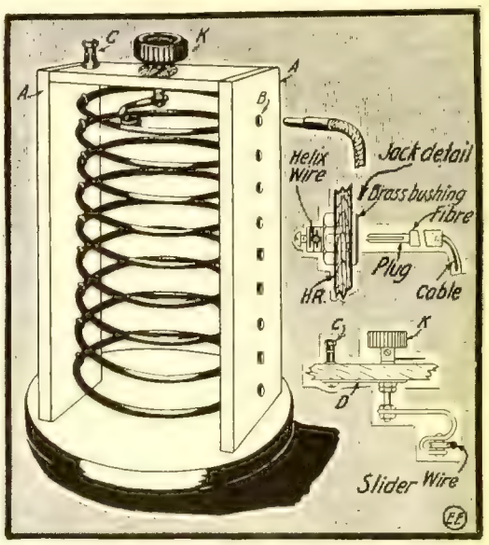
The curves presented, however, indicate that the sunset effect varies with the weather conditions at the time of sunset.

The day strength of the signals varies within comparatively narrow limits, but the average strength of the signals during June and July is noticeably less than that during December and January. The lower curve shows the variation for one month, day by day, in strength of signals.

The variations in strength of signal from day to day are comparatively slight, but they are noticeably greater for March and July than they are for December and January.

## A COMMERCIAL TYPE HELIX.

The wireless sending helix in most amateur stations is generally a cheap affair and oftentimes it is very inconvenient to use. An idea is here given which follows some-




**Commercial Style Helix for the Amateur.**

what the design of several commercial helices and loading coils for transmitting purposes. In making this design it is best to construct the two uprights A and the top cross-piece, of hard rubber or some well-dried hardwood thoroughly boiled in wax.

Eight to twelve turns may be used in the helix, about 6 inches in diameter, and spacing them ⅝ to ¾ inch apart. The wire may be about No. 6 B. & S. for small sets and of aluminum, brass or copper. Contact with one side of the circuit to any number of any complete turns is given by means of a jackboard B, detail of the construction of same being given in the sketch. By arranging a rotary knob and contact arm with wheel for the top turn, it is possible to quickly make conection with any part of one turn, as will be evident. The top turn of wire should, therefore, be made practically horizontal as regards all parts of the turn, so that the wheel will follow around same quite truly.

The jackboard and receptacle for same may be purchased from any telephone supply company, or they can be made up by the experimenter who happens to have a lathe at hand. A wax impregnated wood base may be used for the helix, etc. The other side of the circuit is connected to the rotating arm K, through a brass strip D and post C.

---

L. Hildebrand, of Denver, Colorado, writes us:

"I take your *'Electrical Experimenter'* and I sure think it is a dandy paper. I don't believe I could do without it."

"Your November issue of the *'Electrical Experimenter'* was the first that I have seen and I am very pleased to find it such a fine magazine. I buy about six different electrical and mechanical magazines a month, and I think this is one of the best ones published for the young Experimenters."

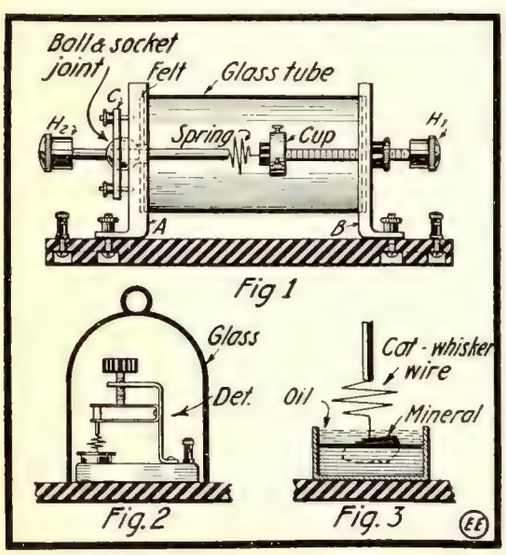
## IMPROVEMENTS ON DETECTORS.

Of all the amateur wireless detectors in use to-day probably not 3 per cent. are properly covered up to protect the crystals against dampness and dust in the air. The best detectors are generally covered by a glass shell in some way, such as Fig. 1 shows. Here a threaded brass rod and handle $H_1$ pass through a threaded hole in the upright B. This rod carries a cup to hold the crystal, and also is tapped and fitted with three thumbscrews to clamp it with. The glass tube or cover is secured in place between the metal uprights A and B, in felt-lined grooves turned in them, as will be seen.

The cat-whisker wire, in the form of a spiral preferably, is carried on an arm $H_2$ which fits snugly but not tightly in a ball clamped under a bar C and two thumbnuts. The ball can be split on one side if desired, to clamp the rod more tightly whenever the bar C is tightened up. Thus the rod $H_2$ can slide lengthwise through the ball and around any angle over the face of the crystal owing to the ball and socket joint formed. The base should be nothing but glass, hard rubber, fiber or marble for highest efficiency. Molded composition is all right also.

At Fig. 2 is seen the easiest manner in which to cover over your detector to keep the dust out. A glass laboratory or watchmaker's bell is placed over it. It may be arranged in a wooden frame and hinges, so it can be tipped back, permitting of quick accessibility to the detector for readjustment.

It is well to cover the mineral with oil, as depicted at Fig. 3, to keep the crystal in first-class shape. Paraffine or other oil can be used.




Three Methods of Improving Detectors.

## THE SENSITIVITY OF THE TELEPHONE RECEIVER.

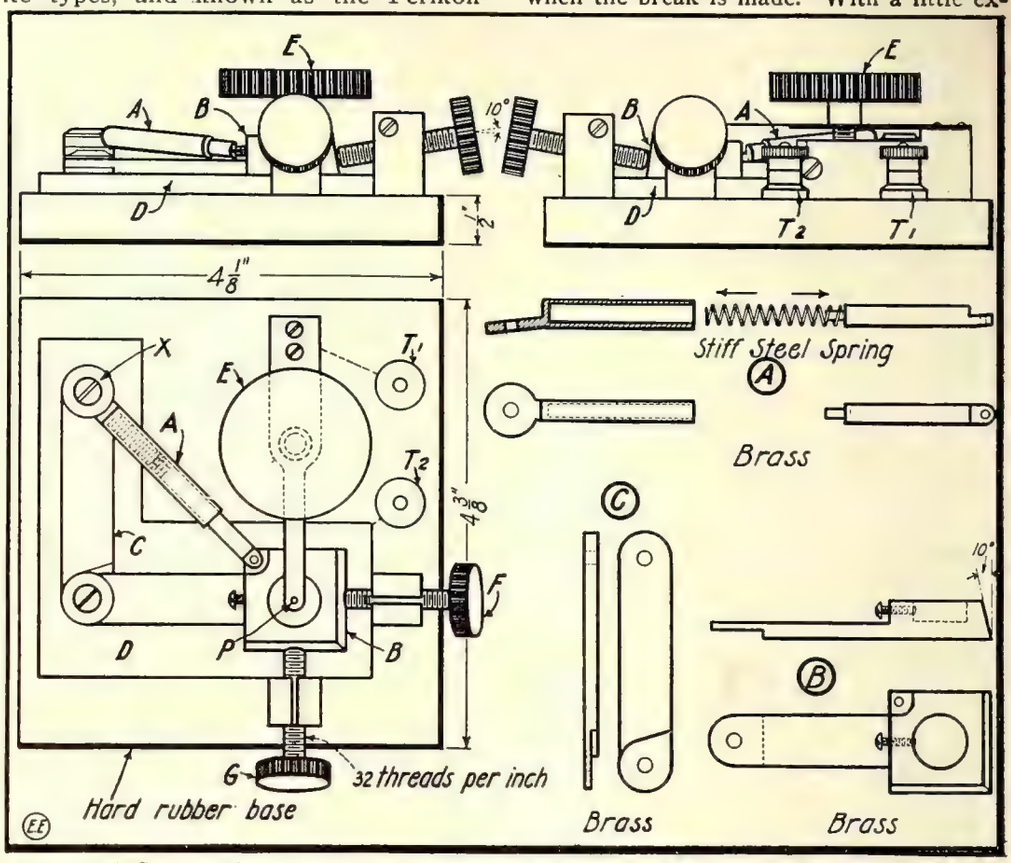
It is truly marvelous how sensitive an ordinary telephone receiver is. Preece calculates that a sound is produced in a telephone by current equal to .000,000,000,000,6 (six ten-trillionths) of an ampere in intensity, or such a current as could deposit about .000,000,000,000,03 (three hundred-trillionths of a cubic inch of pure copper in each second of time.

Pellatt calculates that with a voltage of .0005, representing the difference in potential between the two terminals, an audible sound is maintained in the receiver.

Above values may be multiplied by 10 to 25 times if the instrument is a modern wireless telephone receiver.

## THE PERIKON-ELECTRA DETECTOR.

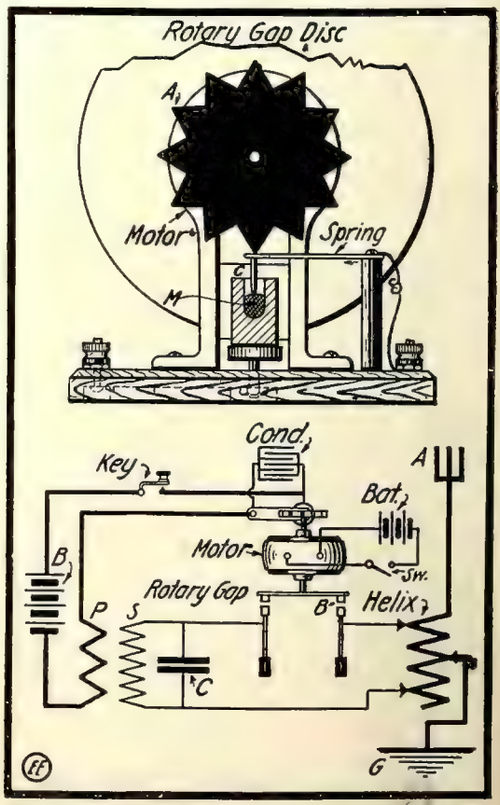
A new radio detector invented and patented by G. W. Pickard, sponsor of the present silicon, perikon and iron pyrite types, and known as the Perikon-Electra detector, is illustrated by the drawing here shown. This instrument consists principally of a very clever mineral stand which by means of properly designed adjustment screws permits the operator to quickly move the mineral cup B to whatever position desired under the contact point of steel or brass, P. Pressure on the point is varied by turning the thumb screw E. Details of the parts B and C are shown in the drawing, as well as the stiff spring and barrel A. The spring A is of the expanding type and when the mineral cup is mounted on the lever system, B—C, swinging on a fixed pivot X, secured to the base frame D, the spiral spring A tends to force the mineral cup B up diagonally against the two adjusting screws F and G. These screws are inclined at an angle of 10 degrees from the horizontal and exert pressure downward on the 10-degree tapered sides of the cup. Hence it becomes possible to simply adjust either screw, F or G, and thus move the mineral about under the contact point until the most sensitive spot is found.




A Detector for Radio Purposes, Capable of Quick and Accurate Adjustment.

## MERCURY BREAK AND ROTARY FOR SPARK COILS.

The accompanying drawings represent a simple apparatus for obtaining a synchronized spark of a fairly high frequency from a battery-operated spark coil. B is an ordinary rotary spark gap with twelve zinc plugs. A is the contact breaker which takes the place of the vibrator on the spark coil. It is made of hard rubber or wood cut out with twelve points which, when rotating, make and break the current for the primary by making the brass point C come in contact with the mercury M contained in the carbon cup. A condenser should be put across the points of contact to reduce sparking. The cup is adjustable. The break disc should be set in such relation to the gap that the break occurs just as the plugs on the gap are approaching the stationary electrodes. The quicker the action of the spark coil the shorter must be the distance between the plugs when the break is made. With a little experimenting the right distance will be found. The apparatus is driven by a battery motor. With a motor speed of about 2,000 r. p. m. a spark frequency of about




400 per second will be obtained. Amateurs depending on batteries for transmitting will find that this machine will give a much higher pitched spark than with spring vibrator. The motor does not take much battery power to run.

Contributed by W. MORRISH.

# Intensifying Radio Signals.

By Henri Sécore.

SEVERAL unique schemes for intensifying the weak signals received in radio-telegraph stations are mentioned in the French journal, T. S. F. (Télégraphie Sans Fil), and we describe the more interesting of these simple arrangements for intensifier experiments herewith.

The first method of constructing an intensifier is that illustrated at Fig. 1, where three carbon pieces C, C, C1 are mounted delicately on the diaphragms of two high resistance radio receivers T T. These receivers TT are joined in the place of the regular head 'phones of the wireless receiving circuit. The carbon piece C1 is pivoted between two indentations in the faces of the two upright carbon blocks C C, thus forming a microphone. When the diaphragms of the wireless 'phones T T move, due to incoming signal current acting on them, they also cause the resist-

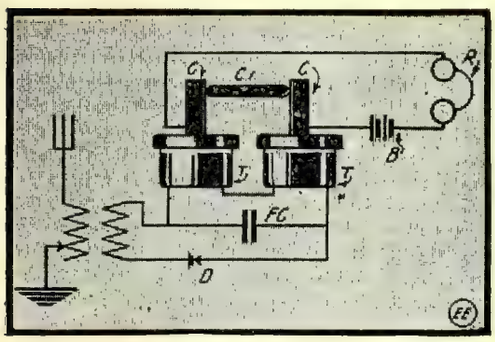



Fig. 1. Microphonic Form of Amplifier.

ance of the carbon block circuit or "microphone" to vary. This action causes a strong local battery B to act on a second pair of 'phones R, which can be 75-ohm type receivers, etc.

Another *stunt* is that outlined in Fig. 2, where a phonograph reproducer P with horn H is caused to give loud signals by virtue of the stylus or reproducer point resting on the diaphragm of a 75-ohm receiver T. This receiver is acted upon by varying current strengths from a battery B through a carbon grain microphone M. This microphone has its mouthpiece removed and is carefully placed in position against the diaphragm or cap of the high-resistance 'phone R, connected to the regular radio set. It may be remarked that the Editors have found these arrangements to work best when the diaphragm of the microphone M is glued or otherwise rigidly connected with the receiver R diaphragm.

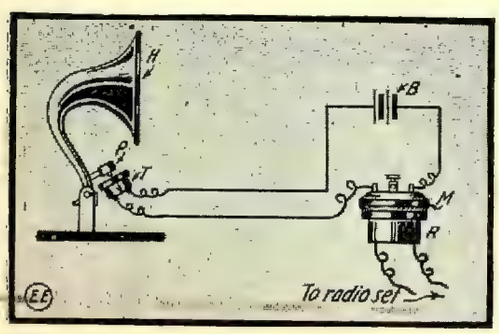



Fig. 2. 1,000 Ohm Receiver and Microphone Form This Amplifier Together with Phonograph.

A scheme similar to the last one was advocated by Stanley Hyde in *Modern Electrics*, but in a simpler form, i. e., the phonograph reproducer stylus was placed in contact with the diaphragm of the high-resistance wireless 'phone directly. Here, however, there is a chance to amplify the

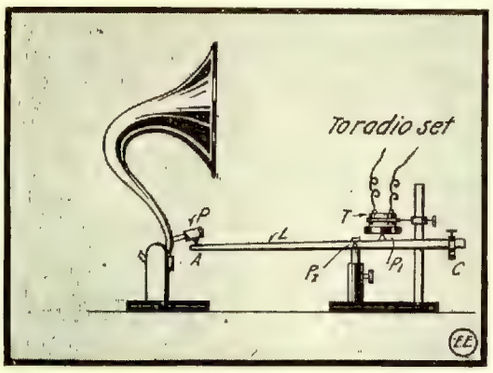


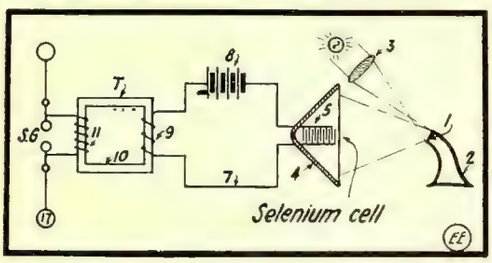

Fig. 3. Amplifying by Lever Action.

signals by controling the microphone "booster" circuit T M B. Those not having access to a phonograph reproducer may simply place a good size horn on the receiver opening of T, the diaphragm vibrations of it being heard then in the horn H.

The old principle of unbalanced lever action is employed in the arrangement indicated at Fig. 3. In this outfit, as shown, a delicately pivoted lever L is caused to act on the phonograph reproducer stylus P, at A, whenever the opposite end of the lever point P1 is acted upon by the movement of radio receiver (T) diaphragm. As is well known, if the lever is pivoted at $P_2$, or off center, then an increased motion radius is given at A, compared to the motion radius imparted at $P_1$, and which difference in movement amplitude is directly proportional to the ratio existing between the long and short arms of the lever L. A, C is a balance weight. The pivot $P_2$ is movable up or down on fulcrum rod with setscrew and sleeve as indicated.

## SELENIUM CELL FOR WIRELESS TELEPHONE CONTROL.

A recent patent issued to a Brooklyn, N. Y., inventor possesses some very inter-




esting points which will, though perhaps not immediately practical, nevertheless become useful, undoubtedly, when the well known selenium cell is more perfected.

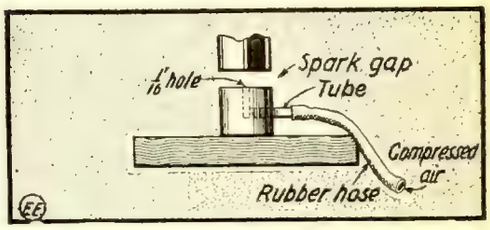
The diagram here given shows how this inventor intends to make use of the properties of the selenium cell (which lowers its resistance when a strong light is thrown on same, and vice versa) by placing the selenium cell 5 in the focus of a reflector 4. A mouthpiece 2, into which the voice waves are projected, has fitted on its inner end a small mirror 1. As the varying voice air waves impinge against the diaphragm and its mirror 1, it causes a corresponding varying beam of light to be projected onto the cell 5. This light is projected onto the mirror from some source of illumination placed behind lens 3. The selenium cell thus causes a changing resistance corresponding to the voice fluctuations at 2 to react through the transformer circuit 7, 8, 9, and thus sets up corresponding spark waves in the secondary of this transformer, as will of course be evident.

## AN AIR BLAST SPARK GAP.

The spark gap has long been known as the most wasteful piece of apparatus in the sending set. The result is that experimenters have spent much time trying to overcome its disadvantages.

The object of special rotary gaps, etc., is to hold up the resistance of the gap, which falls very low, due to the heat of the passing spark, and also to the ionization of the air in the gap. By cooling the gap the former is done away with and an air blast will accomplish the latter by blowing the ionized air from the gap similar to a rotary type gap.

An air blast gap can be easily made from a plain zinc spark gap that will give good results. Remove the lower zinc plug and drill a 1/16-inch hole through its center. Drill another hole ⅛ inch diameter into




Compressed Air Spark Gap.

one side, so it will connect with the small hole. A brass or copper tube 1 inch long is forced into this hole to make a tight fit.

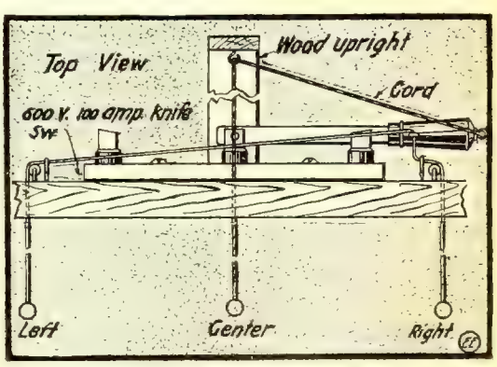
Replace the plug in the stand so the tube will project out at the back. The gap is connected in the circuit and a small rubber tube is slipped over the brass tube and long enough to reach the floor.

The air may be supplied by a bellows operated by the foot; or a better way would be to get a small tank and compress air into it and regulate its flow to the gap by means of a valve.

Contributed by
THOMAS W. BENSON.

## INDOOR LIGHTNING SWITCH CONTROL.

Herewith is diagram of how I made a grounding switch attachment for my aerial, that is very convenient. It is very handy, and instead of going out in the yard on muddy and rainy days, by pulling the middle string the knife blade is brought into upright position. The other two strings (left and right) will ground or connect the aerial to the instruments. Small pulleys




Aerial Switch Controlled Indoors by Means of Three Ropes.

are best employed to pass the cord around bends and into the small holes cut through the window frame.

Contributed by JAMES R. ALLEN.

# The D. C. Arc for Wireless Telegraphy and Telephony

## (Concluded)

### Majorana's Liquid Transmitter.

The illustration at Fig. 15 explains the principle of Majorana's transmitter. When water passes thru a small hole in the end of a tube, as shown at A in the diagram, it continues to flow in an unbroken column for some distance and then it breaks up into drops as shown at B.

Majorana's transmitter is shown on the right-hand side of the diagram. Tube A is in this case fitted with a small elastic

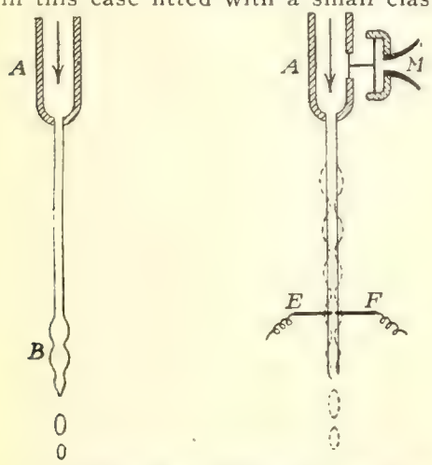



**Fig. 15. Showing the Principle of the Water Stream Microphone.**

partition near its end. This is attached to a rod leading from the diaphragm M. Two small rods or plates E and F are arranged near the bottom of the column just above the place where it forms into drops. These rods just enter the column a very little way and are connected to the circuit conveying the current which we wish to control by the voice.

Now, on speaking in front of M, vibrations are conveyed to the liquid by the rod from the diaphragm, and a sort of wave motion takes place down the column as shown in this diagram, its form depending on the voice, so that the electrical resistance of the column between the two rods is continually changing in exact accordance with the sound waves acting on the diaphragm.

The conductibility of the column can be varied within certain limits by the size of the hole in the tube and by the character of the liquid employed, whether it be acidulated water, salt water, mercury, etc., and also by adjusting the distance between the rods.

### Vanni's Liquid Transmitter.

At Fig. 16 is depicted the transmitter which was used recently by Dr. Vanni in Rome in connection with a Morretti arc generator. Successful transmission of speech was accomplished between Rome and Tripoli, a distance of over 600 miles.

A small jet of acidulated water passes thru nozzle N on to a small plate F attached to diaphragm D; it splashes off this on to a fixed plate G; every movement of the diaphragm alters the resistance of the liquid between the two plates. The diaphragm may either be operated on directly by the voice, or it can be connected to a distant telephone circuit by means of the electro-magnetic device shown here.

Now a word or two as to the reception of signals when arc generators are employed for transmission.

When telegraphing, the arc generator is kept working all the time, and the signals are transmitted by shorting several turns of either the primary or secondary inductance by means of a Morse key, thus putting the transmitter either into or out of tune with the receiving station by altering its wave-length.

Fig. 17 shows Poulsen's connections for reception. As no interrupter is employed at the transmitting station to break up the wave train into groups of waves whose frequency is sufficiently low as to be audible in a 'phone, no signals can be heard with ordinary receiving connections. A small vibrating contact-breaker is, therefore, employed at the receiving station, known as a tikker. When using this instrument no detector is required. Its action is as follows:

The receiving circuit is intermittently connected by a tikker to a large condenser O (about 1 microfarad capacity). During the time of contact the condenser becomes charged, and when the contact is broken it discharges thru the telephone, producing a note corresponding to the frequency of the tikker interruptions. Mr. Child, of the London Telegraph Training College, has very kindly lent me a tikker which I shall be very pleased to show to anyone interested at the close of the lecture.

For the reception of speech, the detectors and connections used are similar to those for spark signals, the most sensitive detectors being those of the crystal type, such as Pickard's original silicon detector, or a zincite and copper pyrites detector. Electrolytic detectors are particularly reliable for telephony, and Fleming's oscillation valve also acts very well.

Fessenden has invented a very clever telephone receiver, which he terms the "Heterodyne." It consists of two small coils, one wound on a fixed core of fine iron wires, and the other attached to a mica diaphragm having its plane parallel to the first. The first coil is connected to a local source of "high frequency" current tuned to agree as exactly as possible with that of the transmitting station; the received oscillations pass round the diaphragm coil. The mechanical

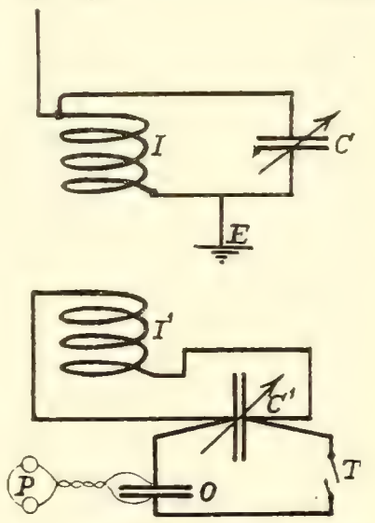



**Fig. 17. Poulsen "Tikker" Receiving Connections.**

force between the two coils varies in accordance with the voice at the transmitting station and reproduces the words spoken.

I have been experimenting myself for some time past with a hot wire telephone on the principle of that invented by Pierce for line telephony in 1880. I find that this telephone can also be connected direct to the oscillating receiving circuit without the use of a detector; but, as you see, the apparatus is very crude and is no doubt capable of much improvement. As this is a lecture on arc systems, I have made very little mention of H. F. alternators.

There is, however, very little doubt that in the near future the Goldschmidt H. F. alternator will be used for wireless telephony, and Professor Fleming thinks that by its employment even Transatlantic wireless telephony may be possible. The time is probably coming when we shall be able to converse with our friends at sea from our own houses, using telephones similar to those so many of us already have installed. We shall ring up the Telephone Exchange

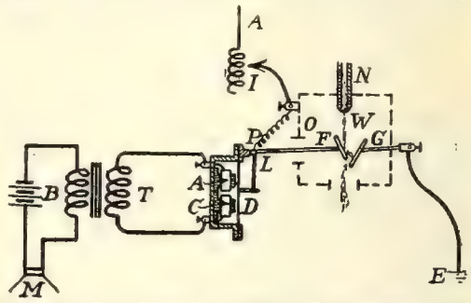



**Fig. 16.—Dr. Vanni's Liquid Transmitter. A Variation in the Liquid Stream N is Caused by the Magnet Coils A-C and diafram D.**

and ask to be connected to some large wireless telephone station on the coast, and the operator there, having got into communication with the ship to which we desire to speak, will connect up our simple telephone circuit to his elaborate wireless instruments, to which he will attend while we converse.

The paper was followed by an interesting debate.

Dr. Erskine Murray, after thanking the lecturer, said that rather debatable ground had been touched on by the lecturer in reference to the Lepel system. It was by no means certain that both the primary and secondary oscillations took place through the spark gap. With reference to the Poulsen system, he said that he had himself, several years ago, seen a Poulsen arc working continuously, without adjustment, for over a quarter of an hour, and it was a great wonder that wireless telephony was not made more use of commercially.

Mr. Binyon said that reference had been made to the Goldschmidt alternator. He was himself employed by the Goldschmidt Co. and was glad that the lecturer was so optimistic as to its future; but he thought that Transatlantic wireless telephony, altho in all probability on the verge of accomplishment, would never become of great commercial value. Transatlantic telegraphy is carried on at high speed in order to cope with the enormous number of messages transmitted. Too much time would be taken up by telephony, and people would not care to carry on important conversations to which any amateur station could listen.

Mr. Maurice Child made some very humorous remarks as to the result of wireless telephony in the Channel. He suggested that some very bad language might be heard if all sea captains were to try and speak to each other at once by wireless telephony.

Mr. Leslie Miller stated that he had seen aluminum used in place of carbon for hydrogen arcs with very good results.

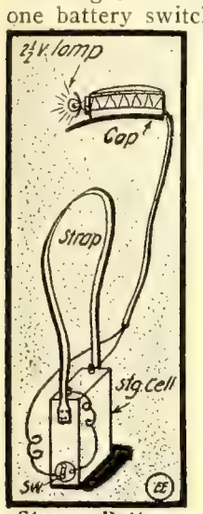
# HOW-TO-MAKE-IT DEPARTMENT

This department will award the following monthly prices: FIRST PRIZE $3.00; SECOND PRIZE $2.00; THIRD PRIZE, $1.00. The idea of this department is to accomplish new things with old apparatus or old material, and for the most useful, practical and original idea submitted to the Editors of this department, a monthly series of prizes will be awarded. For the best ideas submitted a prize of $3.00 will be given; for the second best idea a $2.00 prize, and for the third best a prize of $1.00. The article need not be very elaborate, and rough sketches are sufficient. We will make the mechanical drawings.

## FIRST PRIZE $3.00

### A STORAGE BATTERY HANDY LAMP.

Campers, cyclists and Boy Scouts will find this lamp extremely handy and practical. The articles that are used in constructing this lamp are: One storage cell, one battery switch, one 2½-volt lamp, one miniature socket, 10 feet of annunciator wire or lamp cord.



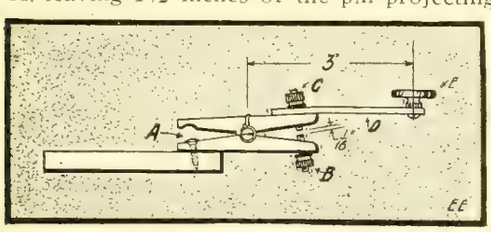
Storage Battery Head Lamp.

The remaining smaller articles can be found around the house. After your storage cell has been charged set it in the pasteboard box that it originally was received in, or better, make a metal carrier for it. Then fasten a leather strap on both sides of the box so it will fit comfortably on your back. Take another piece of leather and make a head band to put around your hat or cap and rivet the miniature socket to it, as shown. On the bottom of the wooden battery switch drive a small nail and bend so as to make a hook to fasten the switch to your coat or any other part of your clothing. Make or buy a little reflector of polished tin or nickel to fasten on the socket. Connect as illustrated and your lamp will be ready for use.

HAROLD B. FINKELSTEIN.

### A CHEAP TELEGRAPH KEY.

A very simple key for experimental wireless work can be made very easily. Procure a piece of wood 3x3 inches and give this a good coat of shellac. Next, get a spring clothes pin and fasten this at A, leaving 1½ inches of the pin projecting



Telegraph Key from Clothes Pin.

from the board. Bore a hole in the upper and lower pieces about ½ inch from the ends. Procure two binding posts off some old batteries, and fasten these in the holes, having them about ⅛ of an inch distant, with clip in normal position. The wires can then be attached at B and C, as shown in the diagram. Place a strip of brass D, under the nut C, with a telegraph knob, E, at the outer end, or the knob may be placed on screw C.

Banana oil or turpentine is excellent for pasting tinfoil on transmitting condensers.


# NOTICE!!!

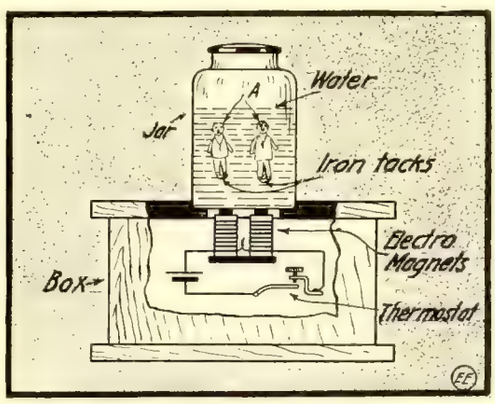
**We wish to buy May, '13, Oct., '13, and Jan., '14, copies "E. E." Address the Editor.**


## SECOND PRIZE $2.00.

### A NOVEL ELECTRICAL WINDOW ATTRACTION.

A novel attraction for a window display can be made from a fruit jar filled half way with water and supported over two electro-magnets, which are mounted in a box or covered over with some cloth as shown in illustration. Two or three small figures A are made from cork and painted with some white paint. Now insert on bottom of each figure A an iron tack or a small iron nail.

When everything is ready connect the electro-magnets in series with a thermostat and place the figures in the water. As soon as the current is made the figures will dive to the bottom of the jar, and when the magnet is opened the figures will rise again



Electrical Window Attraction.

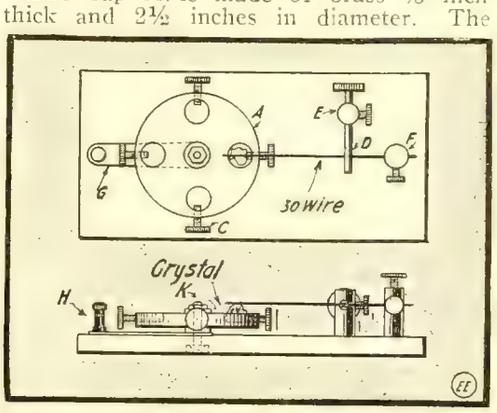
to the surface. The operation is continuous as long as the thermostat makes and breaks the circuit. Thermostats are readily purchased in any electrical store.

CONTRIBUTED BY L. WEISS.

### A ROTARY "CAT WHISKER" DETECTOR.

For all around service the universal or cat whisker detector gives good results. The cat whisker detector herewith described is easily made.

The cup A is made of brass ⅜ inch thick and 2½ inches in diameter. The



Rotary Mineral Holder.

holes are ⅝ inches in diameter. The brass screw K holds A to the base, so that it can turn. G is a brass strap 1/16 inch thick and ⅜ inch wide which connects A to the binding post H. This strap is not necessary as the connections can be made with wire under the base. Electrical connections are made with H and F.

All the parts should be nickel-plated and polished.

## THIRD PRIZE $1.00.

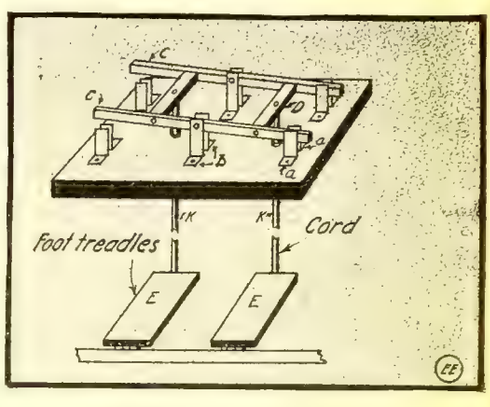
### A FOOT-CONTROL AERIAL SWITCH.

This switch is designed to give rapid switching of the aerial circuit connections to the foot control of the operator. When he is using his instruments he sometimes finds it rather difficult, after sending, to throw the switch and make all the necessary adjustments before the return call commences to come in. This device, by eliminating one movement at least of the hands, saves time.

The sketch illustrates all the parts required. If desired the eight parts A may be substituted by four parts made in one piece; the same also applies to B. The instrument may be mounted directly on a table or may have a base, and may then be placed on the table, through which the holes for the treadle cords have been previously bored.

Too much pressure should not be applied to the treadles, as undue strain might injure the switch.

The blades CC can be of copper or brass bar about ⅛ to ⅛ inch thick by ½ inch wide and 8 to 10 inches long. The



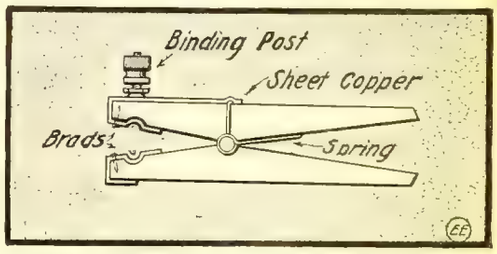
Foot-Operated Aerial Switch.

base is best made of waxed wood or marble. The jaw contacts AA, etc., should have their upper ends slightly flared out so the blades will enter them without binding. The cross bars DD are of fiber or hard rubber. Contributed by

A. D. R. FRASER.

### A HELIX CLIP.

An efficient helix clip may be made from an ordinary spring clothespin. Fasten a thin piece of sheet copper on the inside of each jaw of the pin, using small brads, and let one piece lap back on the inside of the



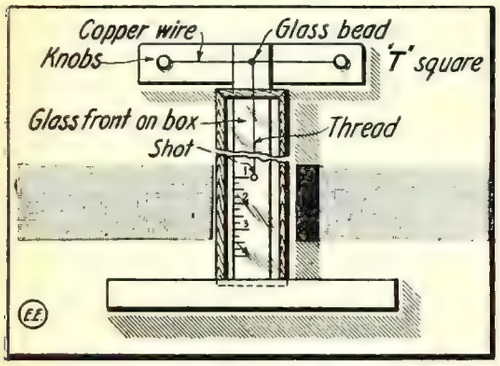
Helix Clip of Simple Construction.

pin for about half an inch. Solder a flat head 8-32 machine screw on the overlap and screw a nut from a dead dry cell on this to form a binding post.

## "SIMPLEST" HOT WIRE AMMETER

The diagram shows how to make a simple but accurate device for finding the best radiation of a radio transformer of a half kilowatt or over. The device is simple and can be made by most every wireless experimenter.

Two small knobs are attached to the head of the T-square and a No. 36 copper wire stretched between them. From the




**Very Simple Hot Wire Ammeter.**

center of this wire is suspended a small lead shot on a silk thread, with a glass bead.

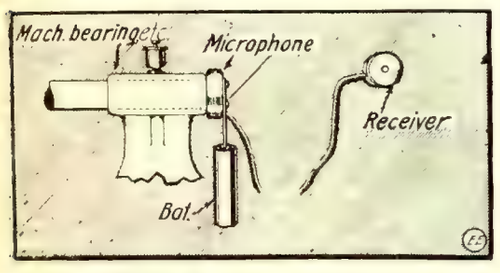
When put in series with the ground, the wire expands, causing the shot to drop slightly; and, after adjusting the helix clips till the shot is lowest, the greatest radiation is obtained.

For some transformers the wire may have to be larger or smaller than 36, depending on the transformer used.

Contributed by
RANDOLPH ROLAND.

## DICTAGRAPHS FOR TESTING MACHINERY.

The ultra-senitive telephone set, commonly known as the Dictagraph or Detectiphone, is applicable to many different problems encountered in every-day work. A very useful application of this instrument to the requirements of machine erectors, etc., is illustrated in the sketch. Here the extremely sensitive microphone transmitter of the dictagraph is placed in contact with the metallic frame of the machine or, in the case of a shaft bearing, at the end of the journal housing, as seen in the cut.




**Dictagraph Helps Machinists to Hear Knocks in Machinery.**

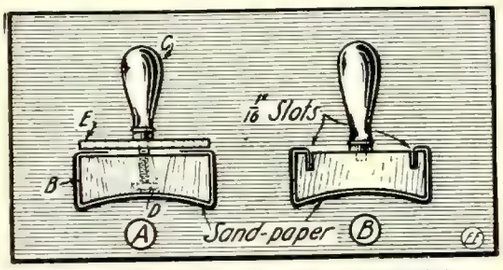
By listening in the telephone receiver of this set the slightest knocks or other undue noises in the machine, which would not, perhaps, be perceptible to the ordinary ear unaided, will be heard plainly in this instrument. This form of telephone is simply a series instrument, and the battery, microphone and receiver are all joined in series. It is therefore easily possible to rewire same and place the battery at any point in the circuit desired, or the circuit may be made as long as 50 to 75 feet. No. 16 lamp cord can be used for the circuit under such conditions.

---

Always connect the lead-in wire from your highest point and avoid leaving kinks and unnecessary turns in it.

## SAND-PAPERING COMMUTATORS.

One of the commonest jobs the electrician around motors in industrial plants has to bother with is keeping the commutator in good shape. All commutators at some time or other tend to burn and blacken a little bit, and a common remedy to smooth them while they are running is to apply a piece of sandpaper. We show herewith a couple of commutator blocks made out of hardwood suitable for holding a piece of sandpaper nicely without fear of shock to the electrician or motor attendant. In the model shown at A a back piece of wood E is caused to clamp the sandpaper tightly when the handle C is tightened up by means of its threaded stud and nut secured in a recess in the center of the block, this nut being, of course, square or hexagonal in form so as not to turn. The second form of sandpapering block at B in sketch is very simple to make, and has two 1/16-inch slots cut in the two sides of same at the back. The sandpaper is then simply fastened in each slot, and may be held by a thin piece of wood if desired. In either case it should be noted that for best results, and as followed out in one of the largest industrial plants of the country, it is al-



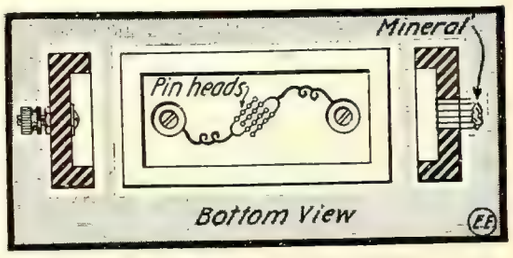

**Sand-Paper Blocks for Dressing Commutators.**

ways best to have several of these blocks with different radii curves on their faces to cover the range of several sizes of commutators which may be around the plant. It is not advisable to use a flat block face.

A useful hint in this direction lies in the use of a common scythe-sharpening stone, which is quite soft and nonconducting. When a commutator is badly cut and temporary improvement is necessary in the operation of the motor such a stone is pressed on to the commutator, and it is thus dressed down while running. Always use sandpaper for commutator work and never emory paper.

## PIN-POINT MINERAL TESTER.

The pin-point detector and mineral tester is constructed with two battery screws, two battery thumb nuts, two washers, 16 common brass pins, one block of soft wood 3 inches long by 1½ inches wide by ¾-inch thick. Hollow out the block, as is shown in drawing, leaving the sides, ends and tops one-quarter of an inch thick. In the middle of the block drive your pins in rows, being careful that the




**A Pin-Point Mineral Tester.**

pins do not touch each other and allowing the points to project through the top about one-sixteenth of an inch. Connect the pin-heads as shown in drawing, soldering the lead wires to the pin-heads and binding screws. Place a piece of mineral on the pin points as in drawing No. 1. To adjust the detector rap it lightly so as to jar the mineral.

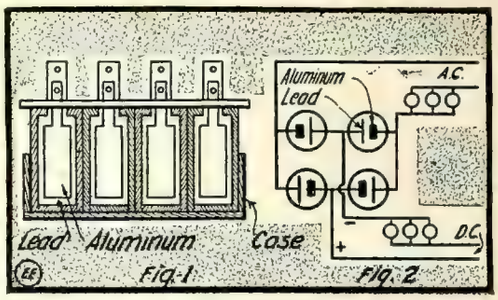
This detector will be found very handy for testing mineral, as there is no adjustment screws to handle. I find this detector much more sensitive than anything I have ever tried.

Contributed by C. P. STONE.

## HOW TO MAKE AN ELECTROLYTIC RECTIFIER.

A very simple device which will change an alternating current to a direct current can be constructed for less than a dollar.

First obtain four jars (see Fig. 1) and place them in a suitable box. Next obtain a board just large enough to go across the four jars. Mark a circle on the board under each jar. Mount then an aluminum




**Four Cell Electrolytic Rectifier.**

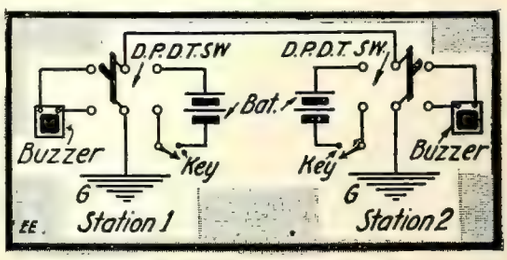
and a lead plate ½-inch apart under each circle, as shown. The lead plates should be a little larger than the aluminum plate; a suitable size is 4x6x⅛ inches. Both plates can be fastened to the cover by bending over a ⅜-inch ear at the top and using some wood screws.

Fill the jars to within 1 inch of the top with an electrolyte made by dissolving as much sodium phosphate as possible in the water and adding a few drops of sulphuric acid for low voltage rectification, such as 12-20 volts, etc.; connect the cells as shown in Fig. 2. This rectifier may be used on an alternating current circuit up to 220 volts. On 110 volts it will give 3 to 3½ amperes D. C. at 80 volts, and on lower voltages it will operate with reasonable efficiency. It will take about half an hour for the plates to form after the alternating current is turned on. Both halves of the cycle are rectified with this rectifier.

## A BUZZER TELEGRAPH SYSTEM.

The sketch, I think, will be interesting to your readers.

The diagram shown is for an open circuit telegraph set that most anybody can easily put up. It requires the following apparatus: Two D. P. D. T. switches, two




**Simple Buzzer Telegraph System.**

buzzers, two keys and batteries. To operate the set the switch handle is always left on the receiving or buzzer side. When the operator wishes to send he throws it on the right and calls the other party.

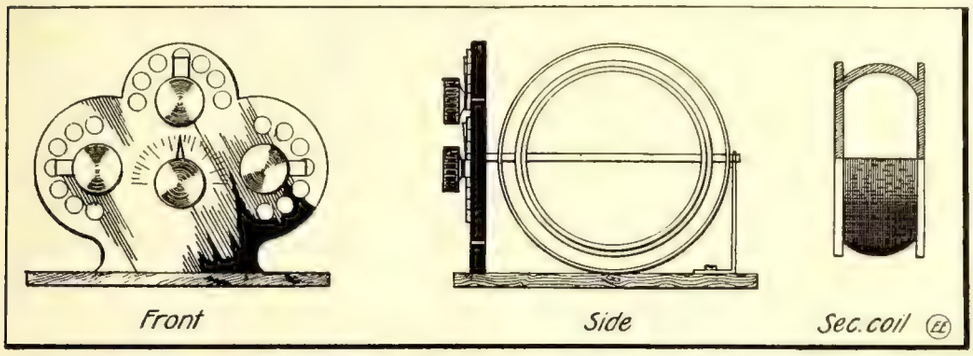
I have used this set for some time and get fine results.

Contributed by FRANK HARAZIM.

## AN UNUSUAL COUPLER.

It is a well-known fact that the efficiency of most receiving sets is very low. This loss is due to the inefficient method of transforming the oscillations from the antenna to the closed or detector circuit. This loss is especially great when two couplers are connected in cascade for elimination of interference. The coupler here described, although not new, is seldom, if ever, seen in the amateur station.

We know that when undulations energize the aerial it sets up a weak magnetic field about the primary. Now, in order to energize the detector circuit to a maximum it is up to us to construct a secondary suitable to absorb the most lines of force. So we make a form like the one in illustration, which has many advantages over the common cylindrical form. This can easily be turned on a lathe.




**Particularly Efficient Form of Loose Coupler with Spherical Secondary.**

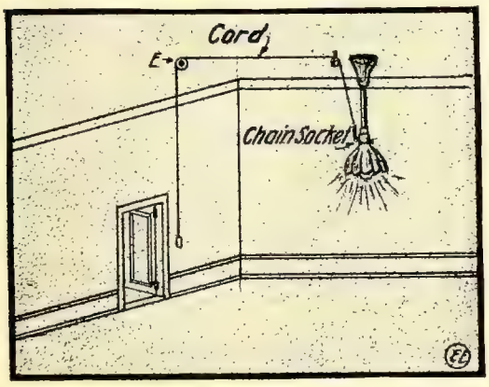
Start winding your coil from both ends and then solder them together at top, taking taps about every twenty-fifth turn to vary inductance. Any number of layers can be used.

The primary coil is of the common variometer type. Start winding at either end, taking taps first 10 and then every other 10. This eliminates the losses otherwise due to sliders. Sizes 24 and 30 B. & S. wire are suitable for primary and secondary, respectively. The illustration elucidates the minor details. A coupler built similar to this is very efficient and gives a handsome appearance, as sought by every up-to-date experimenter.

Contributed by ROBT. C. MARTIN.

## CONTROLLING LIGHT FROM THE DOOR.

Quite frequently rooms are lighted by pendant fixtures which are turned on and off by a pull-chain socket at the fixture.




**Controlling Electric Lamp by String.**

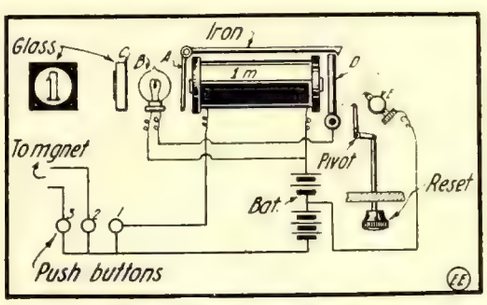
This makes it necessary to grope through the dark room in order to find the chain. This annoyance may be obviated by the use of a piece of cord and two screw eyes E, as shown in the drawing. Screw pulleys would be better but are not necessary, as the cord will pass easily through the eyes. A small porcelain insulator hung on the end of the cord will serve as a hand grip and will also tend to keep the cord taut. By using a cord of the same color as the paper over which it passes a very neat job may be made indeed. A rubber band may be placed in the cord line so as to prevent severe jerking of the socket mechanism. Contributed by

HAMILTON A. HOOPER.

## FLASH-LAMP ANNUNCIATOR.

A different form of indicator or annunciator than the one we are all more or less familiar with is the subject of these few lines. In many cases it is very desirable to have an annunciator operating on the same principle as the telephone switchboard, i. e., where the signals are flashed by means of small lamps placed behind glass bull's-eyes with numbers painted on them.

The arrangement shown in the sketch herewith indicates a very simple arrangement, easily constructed by the amateur electrician and at small expense. Also the principle can very well be carried on to include quite a number of indicators, as will




**Flash-Lamp Annunciator.**

be evident. Briefly, the principle of this flash light indicator is as follows:

An electro-magnet 1M has fitted onto it a soft iron armature A, pivoted as shown; so that when an electric current passes through the magnet coil it will attract the shorter end of A, and thus release the brass switch drop D. This drop then falls onto the contact screw E, thus closing the flash-lamp circuit through the battery. Primarily the signals are sent into the indicator to the respective magnet coils 1M, etc., from the push puttons 1, 2, 3, etc., placed in various parts of the building. The glass disc C can be made of ordinary glass and the front of same painted with some lampblack as shown. After each signal has been answered by the attendant the drop D is readily reset by the small button as shown in sketch.

## HINT FOR CONDENSER MAKING.

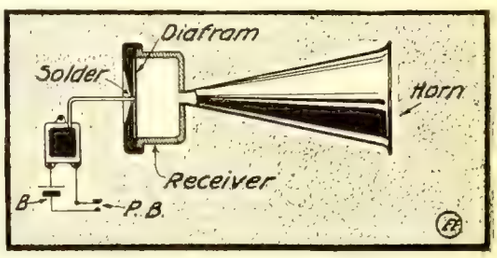
Use a warm, flat iron, instead of the old-time hot knife and roller, to make your condensers and you will be surprised at the ease with which it can be accomplished. The condenser will be much more compact than it could possibly be made by rolling, thus increasing the capacity likewise.

Contributed by

ARTHUR R. DARLING.

## HOW TO MAKE AN ELECTRIC HORN.

The following material will be needed in building this horn: An old watch case receiver, an electric bell and a wood base of any size; also a block for the bell to rest on. Now remove the magnets from the receiver and drill a 5/8-inch hole through the back of the shell. Next procure a tin horn at a toy store for about 10 cents and remove the whistle on the inside. Next cement the horn to the holder in the back



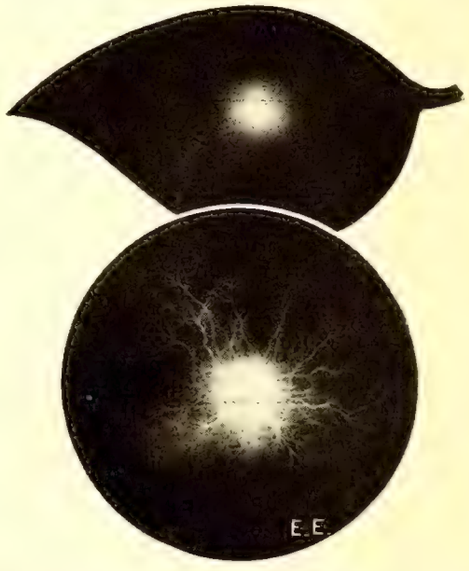

**Easily Made Electric Horn.**

of receiver, or solder it in place if the shell is of metal. That having been done, replace the diafram and screw the cap on. Next cut the ball off the tapper of the bell, remove the gong and bend the rod at right angles as shown in figure. Then solder the end of the arm to the diafram. This horn will give a loud sound, especially if used on five to six dry cells B. A push button is placed at PB.

## SPARK PICTURES.

The photos of sparks herewith reproduced were taken with a one-inch spark coil, but the batteries were run down and the sparks would only jump a half inch. However, the picture turned out quite satisfactorily. For the benefit of the reader I will describe the experiment. The material used consists of a photographic plate, metal plate, talcum powder, two pieces of wire and a needle. (The photographic plate should not be exposed to any light.)

First of all fasten one wire leading from either of the secondary posts of the spark coil to the metal plate. Place the photographic plate on the metal plate, with the gelatine side up, and sift the talcum pow-




der through a piece of cheesecloth evenly over its surface. To the other secondary post of the coil fasten the other wire. Attach the needle to the other end and hold it on the middle of the plate. Make one spark, brush off the powder and the plate is ready for developing. Startling results can be obtained if the above is carried out correctly.

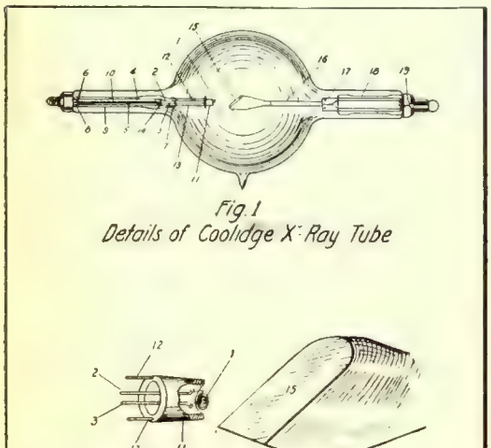
Contributed by WM. A. STEPHEN.

## THE NEW COOLIDGE X-RAY TUBE

The new Coolidge X-ray tube is a direct outcome of Dr. W. D. Coolidge's previous invention of ductile tungsten, the physical properties of which enable its substitution for platinum as the target or anti-cathode in X-ray tubes.

The Coolidge tube is shown in detail in Fig. 1, while Fig. 2 gives details of the cathode and front end of the target.

The construction of the cathode can be seen from Figs. 1 and 2, in which (1) is a tungsten filament forming a flat, closely wound spiral. This tungsten filament (which consists of a number of convolutions) is electrically welded to heavy molybdenum wires (2 and 3), to the other extremity of which are welded the two copper wires (4 and 5), these being in turn welded to the platinum wire (6). To insure rigid support for the hot filament the molybdenum wires are sealed directly into a piece of special glass (7) which has the same coefficient of expansion as molybdenum. The outer end (8) of the supporting tube is of soda glass like the bulb itself, and it is therefore necessary to interpose at (9) a graduated series of different kinds of glass to allow for the difference of expansion of (7 and 8). A small glass tube (10) surrounding one of the copper leads prevents short-circuiting of the copper wires (4 and 5). The tungsten filament which forms the cathode is heated by a current from a small storage battery, which should be carefully insulated from the ground. An ammeter and an adjustable rheostat in the circuit enable the heating current to be regulated with great nicety between 3 to 5 amperes. This range of current gives a potential drop through the filament of from 1.8 to 4.6 volts, variations of the corresponding filament temperature being from 1,890 to 2,340 degrees absolute.




**The Famous "Coolidge" X-Ray Tube.**

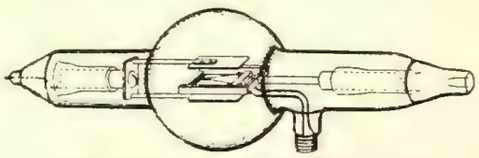
The focusing device consists of a cylindrical sleeve of molybdenum (11). It is mounted so as to be concentric with the tungsten filament, with its end projecting about 0.5 mm. beyond the plane of the latter. It is supported by two stout molybdenum wires (12 and 13) which are sealed into the end of the glass tube (7) (see Fig. 1). The sleeve is electrically connected to one of the filament leads (14). This, besides acting as a focusing device, also prevents any electron discharge from the back of the heated portion of the cathode. The anti-cathode or target (15), Figs. 1 and 2, also serves as an anode. It consists of a single piece of wrought tungsten welded to a molybdenum rod (16) of cylindrical section and supported by a molybdenum split tube (17). This split tube fits snugly in the glass anode arm (18) and serves the double purpose of supporting the anode and of conducting heat away from the cylindrical rod and so protect the seal of the inlet lead (19). The bulb is made of soda glass and is about 18 centimeters in diameter. The method of exhaustion is very long and complicated, and in the later stages of the exhaustion a very heavy current is maintained continuously on the tube for perhaps an hour, the temperature of the bulb being kept from rising too high by the use of a fan. The pressure in the finished tube is very low.

The main advantages of the Coolidge tube are the following: The quantity and the pentrating ability of the rays produced can be varied independently at the will of the operator with both ease and rapidity. When the tube is once adjusted to the requirements of the operator it needs no further attention. Both the intensity and the penetration of the X-rays are under the complete control of the operator. A higher penetration than can be obtained from any other tube is claimed, as well as a longer life. The tube can be worked off either alternating or direct current. Hence it is possible for an operator in actual practise to do all classes of work, ranging from that calling for the lowest to that calling for the highest penetration, with a single tube. Further, he can reproduce exactly what he or some other operator has done before. The adjustments are rapid and require the minimum of technical skill. It has been found that once the proper penetration and exposure had been determined radiographs of any object can be duplicated time after time with absolute precision.—*The Electrician*, London.

## THE "KENOTRON" HIGH POTENTIAL RECTIFIER.

A new form of vacuum rectifier is described in a recent number of the *General Electric Review*.

When the electrically heated electrode in the bulb shown is cathode only a thermionic current passes. For a given voltage drop this thermionic current increases with the temperature, but above a certain temperature the current becomes constant. On the other hand, for a given temperature of the cathode the thermionic current increases at first as the positive potential on the anode is increased, but finally a saturation thermionic current is obtained and further increase in voltage has no effect. With a sufficiently perfect vacuum this thermionic current is due to a pure electron emission. The "kenotron" is a rectifier based on this



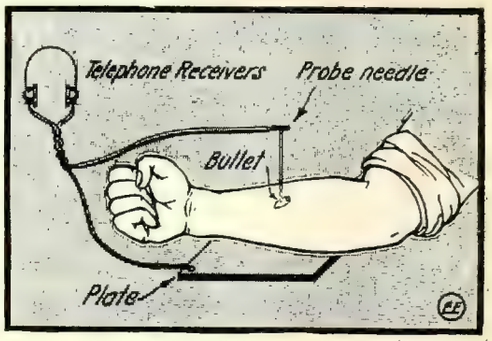
**New Form of Vacuum Rectifier Tube.**

phenomenon, and the article discusses how the design depends on the amount of current to be rectified, the maximum permissible voltage loss and the proper form of electrodes to prevent electrostatic strains on the filament. Three different forms of kenotrons are covered. The first type contains a molybdenum cylinder and a coaxial filament and is suitable for alternating-current voltages up to 15,000 and a current of 400 milliamperes and voltages up to 100,000 and a current of 100 milliamperes. The efficiency of this rectifier is between 98 and 98.75 per cent. A second type of "kenotron," which is suitable for voltages not over 10,000 and currents ranging up to 100 milliamperes, contains a small filament such as is used in automobile head lamps inserted in a molybdenum cap about ⅝ inch in diameter. A third style is shown in our illustration. It contains a V-shaped filament between two tungsten plates.

Hence this new form of rectifier promises to fill a number of engineering wants.

## ELECTRICAL BULLET PROBING.

A new electrical method of probing for bullets is being employed in the military hospitals of Europe, says the *Lancet*, London. It consists of a head telephone receiver such as a sensitive wireless phone, together with a flat metal plate and a probing needle of the same metal. The patient's arm, for instance, is placed on the metal plate, which is connected to the telephone receiver, as is also the probing needle. When the surgeon touches the bullet with the needle there is formed a galvanic battery. This gives rise to an electric current which is heard in the receiver. Sir James MacKenzie Davidson says this method is undoubtedly more certain and easier to apply than the "induction balance," also in use for the purpose.

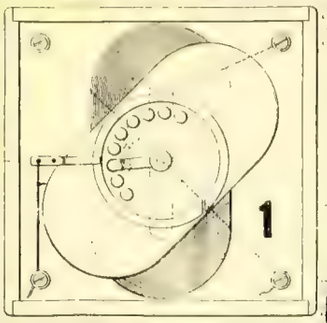


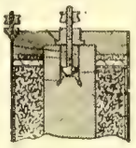

**Locating Bullets with Telephone Receivers Only.**

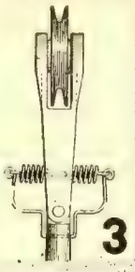
## TESTS OF PERMANENT MAGNET STEELS.

J. A. Mathews has contributed to the proceedigs of the American Society for Testing Materials a paper based upon an extensive series of magnetic tests on steel alloys. The amount of permanent magnetism which hard steel will retain, and the tenacity with which it retains it, are profoundly affected by the heat treatment of the steel, as well as by its chemical composition. But different steels are affected differently by heat treatment. Some have their best permanent-magnet quality in the oil-hardened condition, while others —sixty hundredths per cent. carbon steel and five per cent. tungsten steel—are best when water-hardened. Thus, the "magnetic hardness" does not vary in the same way as physical hardness. Drawing the temper, however, reduces both hardness and magnetic permanence. In some steels, pieces of small section have greater permanence than larger pieces, while other steels have the opposite characteristic. The chief result of the tests made up to the present is that no uniformity of behavior is found among different steels, and that no laws or theories covering the phenomena can be deduced before a great amount of further experimenting has been done. The author found the best index of permanent-magnet quality to be the ratio between residual magnetism and coercive force. He proposes this ratio as a new magnetic unit.

# LATEST PATENTS



## A Brief Digest of the Latest Electrical Patents

**WIRELESS TRANSFORMER** (Fig. 1)—Compact loose coupler with pancake coils independently movable co-axially.

**BATTERY CONNECTION** (Fig. 2)—Improved dowel terminal for carbon electrode in dry cells.

**TROLLEY WHEEL MOUNTING** (Fig. 3)—Wheel is mounted with lateral thrust springs to give wider range of action, so it will not release its hold on trolley wire so quickly.

**LAMP CONTAINER OR BOX** (Fig. 4)—A simple carton to hold electric lamps while in shipment, etc.

**HEAD-BAND ATTACHMENT** (Fig. 5)—An extra flat plate secured to the head-band prevents band catching hair. A good idea and a boon to the telephone exchange operator.

**ELECTRIC SIGN** (Fig. 6)—Has bull's-eye lenses over each lamp, etc. Gives spectacular effect as liquid filling glass, etc.

**MUSICAL DEVICE** (Fig. 7)—Electrically operated striker for musical pipe, as shown.

**PORTABLE ELECTRIC LAMP** (Fig. 8)—Arranged with base attachable to anything. Socket also swivels.

**ELECTRIC SOCKET** (Fig. 9)—Arranged with a pull chain and lever, acting on push button switch.

**STORAGE BATTERY SEPARATOR** (Fig. 10)—Ingenious insulating envelope to fit over battery plates and to separate them from one another.

**WIRELESS RECEIVER** (Fig.) 11)—Magnet spool movable to or away from diaphragm by threaded thumb lever at rear, as shown.

**TELEGRAPH RECORDER** (Fig. 12)—Devised to operate on the sounder principle, the armature bar carrying a stylus, as indicated.

**ELECTRIC HEATER** (Fig. 13)—In the form of a cup to contain liquid and a food cup with perforated walls, held on heating element at center.

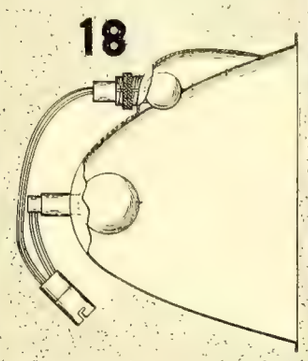
**AUTO HEAD-LAMP AND SIGNAL COMBINED** (Fig. 14)—Horn vibrator is mounted in rear of head-lamp. Openings provided for efflux of sound. Tends to reduce the cost of auto manufacture, as both functions are combined in one chamber.

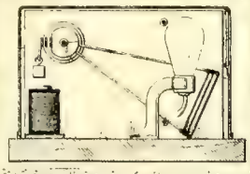
**BEDSTEAD ELECTRIC LAMP** (Fig. 15)—Provided with hooks to hang on bed rail. For reading.

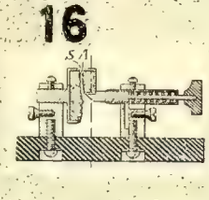
**NEW PICKARD RADIO DETECTOR** (Fig. 16)—Uses silicon "S" and antimony "A."

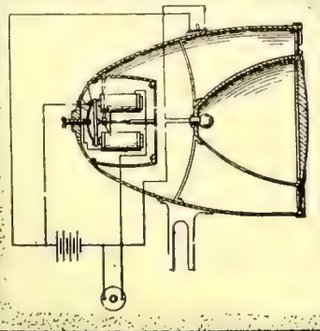
**CORNER-TURNING INDICATOR FOR AUTOS** (Fig. 17)—Electro-magnet control operates sign frame arms, as perceived; signs appear before window with lamp behind them.

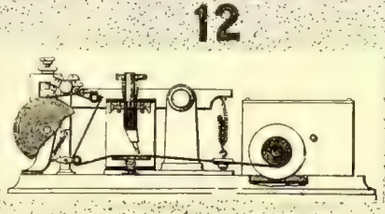
**DUPLEX AUTO HEAD-LAMP** (Fig. 18)—Good idea for providing small, city lamp in pocket at side of parabolic reflector, containing the regular head-lamp.

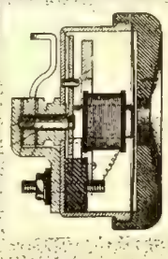


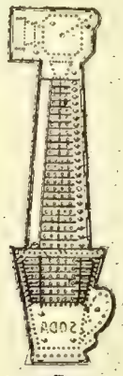



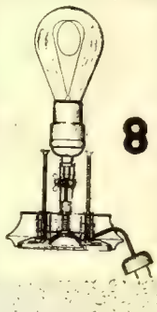



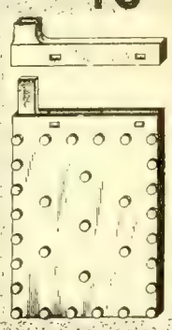








# AMONG THE AMATEURS

Our Amateur Radio Station Contest is open to all readers, whether subscribers or not. The photos are judged for best arrangement and efficiency of the apparatus. To increase the interest of this department we make it a rule not to publish photos of stations unaccompanied by that of the owner. Dark photos preferred to light toned ones. We pay each month $3.00 prize for the best photo. Make your description brief. Address the Editor.

## AMATEUR RADIO STATION CONTEST.

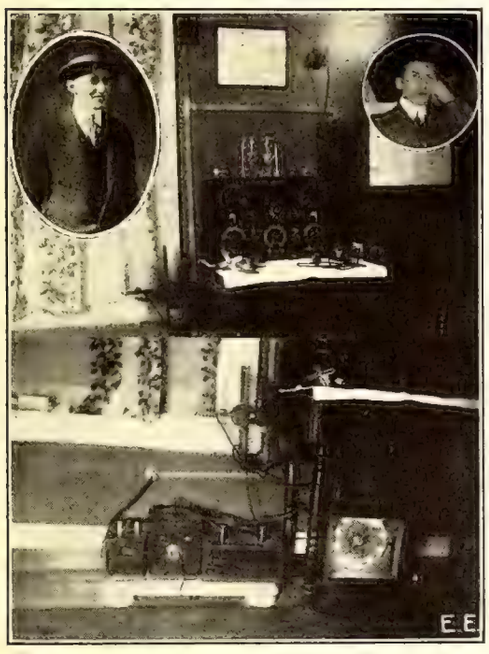
**Monthly Prize, $3.00.**

*This month's prize winner.*

## WAYNE BROS. AMATEUR RADIO STATION.

Herewith are submitted photos of a wireless set, which may interest some of your readers. Before proceeding, allow me to say that this set is of entirely amateur construction, having been built by my brother and myself.

The photos show clearly the outer appearance of the set, but a brief description of the interior follows. I might first say that the receiving cabinet is entirely of hard rubber, and measures over all 20x12x10 inches. Contained within are a receiving transformer, loading inductance, and variable condensers. There are also the two sets of high-voltage batteries for the audions, and also the 1 to 1 ratio transformer for the amplifier. All coils are wound with stranded wire (or litzendraht) which much improves their efficiency, of course, for high frequency. The hook up of the set, which, so far as I know, is original with us, enables us to receive both damped and undamped waves with equal facility, and we have clearly



**Messrs. Wayne Brothers and Their High-Grade Radio Set. Top: Receiving. Below: Transmitting.**

heard on several occasions the high-powered stations at Berlin, Honolulu and San Francisco, which employ the undamped wave system for transmitting.

On ordinary spark sets, we have heard signals from Key West, Colon, and numerous ship sets, covering 1,100 miles in daytime; signals being from ships using the average transmitter employed on shipboard. We have also copied "press" from Poldhu, and have heard time signals from Arlington at a distance of 40 feet from the phones.

The transmitter is all home-made, and of one-half K.W. power. Transformer is of open core type and employs a choke coil to regulate current. Referring to the photo: To the left may be seen the impedance. In the center is the transformer, and to the right the condenser, which is of glass plate type, immersed in oil. The oscillation transformer, which is of the double sliding pancake type, is secured to the table.

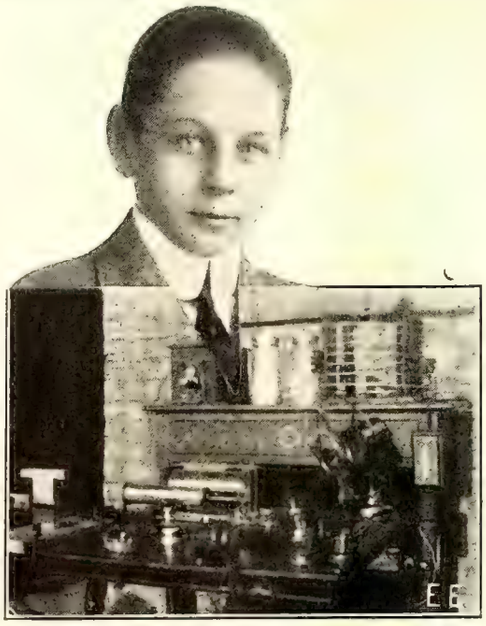
The rotary gap is of the Marconi type with rotating bar, carrying the two electrodes instead of the usual pin-wheel type. This gap has the advantage of starting quickly, and also keeps cooler than the wheel gap. Also the glass-front case containing the rotary is suspended by four spiral springs, which reduce the vibration of the motor to a minimum. We have transmitted 50 miles.

MONROE WAYNE,
A. ROSS WAYNE

New York City.

## WEITH WIRELESS OUTFIT.

The following is a description of my wireless station, located at Chicago, Ill.: My receiving set comprises a double slide



**Master Weith and His Radio Station.**

tuner, variable condenser, fixed condenser, loading coil, battery, potentiometer, galena and also a silicon detector, 1,000-ohm phones and a high note buzzer for testing the detectors. The receiving set is on the bottom part of the table; all necessary switches are used.

My sending outfit is composed of a ½-kw. transformer which runs on the 110-volt circuit, Leyden jars, spark gap, key and oscillation transformer. The sending set is on the top part of the table, except key.

The aerial is 50 feet long and 100 feet high and consists of two wires. I get very good results with this set.

ROYAL C. WEITH,

Chicago, Ill.

The most efficient way to recharge small storage batteries is by means of a small dynamo driven by water motor or gasoline engine.

## RADIO STATION OF RAYMOND MYERS.

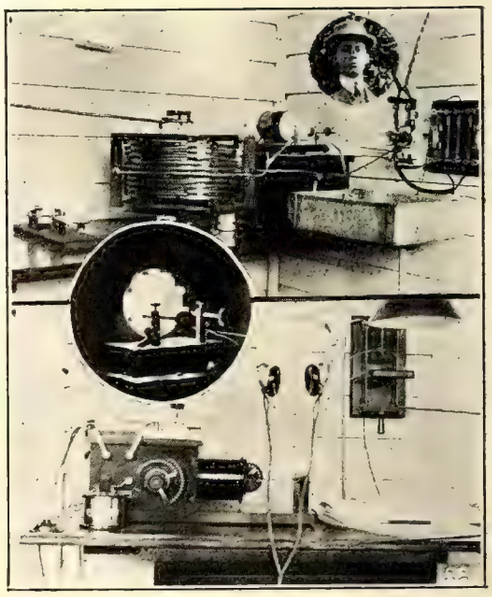
Below is shown the radio equipment of Raymond Myers, Tiffin, O. The sending set consists of Blitzen ¼-kw. transformer, oscillation transformer, rotary gap and an oil-immersed glass plate condenser. The receiving set includes a navy type receiving transformer with dead end switches, Murdock variable and fixed condensers, galena detector and Brandes' 2,000-ohm phones. The aerial is 40 feet high and 120 feet long, composed of four antenium wires on 11-foot spreaders.

With this outfit I have heard all of the near-by lake stations and a great many along the Atlantic Coast south to NAX. Have picked up amateurs this winter from Buffalo, N. Y., to St. Louis, Mo., a few being 8KP, 8BC, 8EG, 8OZ, 9EE, 9EG, CHW, 9BD and have heard 9YN on several occasions. In sending I have been heard 200 miles away and talked with a score of amateurs within a radius of 75 miles. Time and weather reports are received daily at this station from NAA and NAR, and with loading inductances connected in circuit WSL clearly responds.

A Radio Club has been organized in this city, and I would be glad to hear from any amateurs who would like to join. I have a Government radio license (second-grade amateur), and my call letters are 8CT.

RAYMOND MYERS,

Tiffin, O.



**Top Photo Shows Mr. Myers and His Sending Set. Center: Rotary Gap. Below: Receiving Station.**

## TECH WIRELESS CLUB NAMES NEW OFFICERS.

The Tech Wireless Club of Harrisburg, Pa., has elected these officers: President, Prof. Peet; vice president, Prof. Loomis; secretary, Charles Everett Kutz; treasurer, G. Webber Knight.

Besides some minor pieces of apparatus the club will add a new aerial to its equipment this year. The aerial will be in the shape of an angle, one side of which will be seventy-five feet and the other side sixty feet. The apparatus will be greatly increased in strength and the members expect to get into communication with Lehigh University.

## ROCKWELL RADIO LABORATORY.

It certainly is a great idea to incorporate in your fine magazine, *The Electrical Experimenter*, such a contest as the "Amateur Radio Station Contest" is bound to be. Enclosed you will find a flashlight of my wireless and experimental station, and also a photo of myself, which I wish to enter in this contest.

In my receiving circuit I have a loading coil, an E. I. Co.'s loose coupler, a variable condenser, a blocking (fixed) condenser with controlling switch; a potentiometer which controls the current to my E. I. Co. electrolytic detector, and also to my carborundum detector; an E. I. Co. Universal detector stand, using galena with two 2-point switches to throw in either detector with or without potentiometer; a Junior fixed condenser across phones with controlling switch, and 3,000-ohm phones.

On my sending side, I have a 1-inch spark coil which is operated by a transformer which reduces the street alternating current down to eight volts; an E. I. Co. wireless key; a zinc spark gap, sending Helix and a Leyden jar condenser.

Left: Donald P. Rockwell.

Below: His Complete Wireless Sending and Receiving Apparatus.

My aerial is of No. 14 wire, about 120 feet long, of 4 strands, 60 feet high at one end and 40 feet high at the other end.

My ground is a ¾-inch pipe driven 8 feet into the ground. The receiving set has a range of from 1,200 to 1,500 miles, and the sending set a range of from 6 to 8 miles.

In my station I have, besides my wireless set, a telephone and a telegraph, both of which I use in communicating to different friends about the city. In the telegraph circuit I have a sounder, a relay and a key. In the telephone circuit is a receiver and a Stromberg-Carlson transmitter.

DONALD B. ROCKWELL,
17 Walnut St.,
Wellsboro, Pa.

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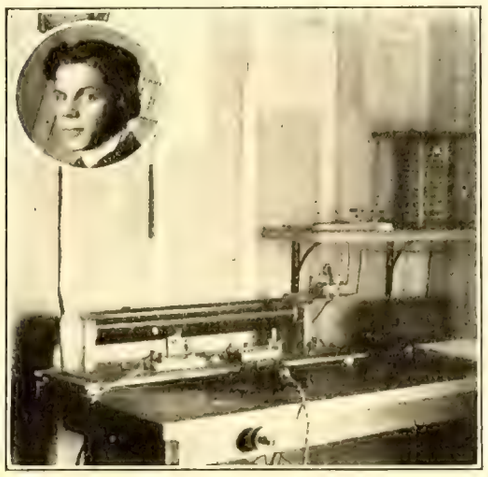
The efficiency of wireless transmission over long distances is very low owing to the scattering of the waves in all directions. Probably the average energy received from a transmitting station is but one one-millionth part of the initial power radiated.

## RADIO INSTALLATION OF J. L. TAYLOR, JR.

I have an efficient wireless station and give you a photo of same, as well as one of myself.

The receiving set consists of double slide tuning coil. Universal crystal detector, Murdock loading coil, 8-point variable fixed condenser and Murdock 1,000-ohm single headset. I also have buzzer test. I hear N. A. A., W. C. C., N. A. D., W. S. L. and many other nearby radio stations.



Mr. J. L. Taylor, Jr., and His Radio Station.

My sending set consists of Mesco key, 1-inch spark coil, spark gap, suitable condenser and oscillation transformer.

Aerial is 65 feet long, consisting of four wires spaced two feet and supported by pole 50 feet high. Lower end of aerial is about 30 feet high and fastened to roof of house.

The ground is an iron pipe driven into ground about seven feet.

I have an amateur's license and also station license. My call is "8 W. S." On the whole, I am quite pleased with my set.

I read the *Electrical Experimenter* and enjoy it very much.

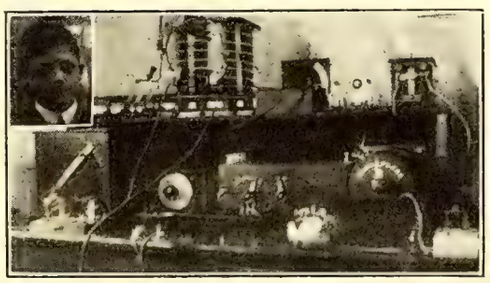
J. L. TAYLOR, JR.
Barker, N. Y.

## PALMER HILL'S AMATEUR STATION.

Below is a photo of my wireless station, which I would like to enter in your wireless station contest.

The sending apparatus consists of a one-inch spark coil, rotary gap, home-made condenser and helix, key and hot wire ammeter, also a rheostat for gap.

Receiving set as follows: Clapp-Eastham and E. I. Co. loose couplers, large, home-made loading coil, fixed condenser, switch box, loading inductance, Var. condenser, galena detector and others for experimenting with different substances, aerial switch and Government receivers.



Palmer Hill's Excellent Wireless Outfit.

Most of the instruments are of standard make, which I find very efficient. The aerial is 50 feet long, composed of six wires, 40 feet high, of the inverted "L" type. I am going to erect a six-wire aerial 300 feet in length for receiving purposes.

I hear all the coast stations from N A B to N A R; also, on Friday, Jan. 8, 1915, between 9 and 10 p. m., I heard wireless telephone messages and music.

PALMER HILL.
Stamford, Conn.

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C. L. Robinson, of Laquey, Mo., writes us as follows:

"I received the April *Electrical Experimenter* which I wrote you about and thank you very much. I am very much delighted with your magazine. I have read several but it is the best I ever saw for the general Electrical and Wireless Experimenter. Success to you."

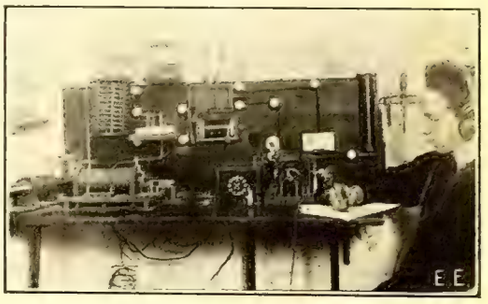
## FLINDT STATION.

The following is a description of my radio station:

Transmitting: One and one-half inch spark coil run on eight dry cells, volt and ammeter for testing, wireless key, Helix and spark gap. I use a high-tension glass plate condenser; wave meter for regulating wave length. I have a range of 10 miles with this apparatus.

Receiving: Loose coupler with variable condenser across primary. I employ a condenser and detector in secondary circuit. Phone 2,000 ohms resistance.

A loading coil is in series with aerial.



Radio Messages "Coming in" at Walter Flindt's Station.

Double-pole, double-throw switch connects either sending or receiving circuit. My aerial is 80 feet long and 60 feet high with four wires. Have caught stations as far as 800 miles away at night.

WALTER FLINDT.
Philadelphia, Pa.

## NEW AMATEUR RADIO STATION AT GARDINER, ME.

The new wireless station installed by F. H. Woodbury, was given a tryout recently and worked perfectly. Many messages were picked up from incoming ships and places all along the coast and the receiving apparatus worked exceptionally well.

Considerable credit is due the men of the Central Me. Power Co., who did the work of establishing the aerials. The work was made difficult because they are stretched from two poles fastened on the peaks of two buildings with slanting roofs of slate that made the work somewhat hazardous as well as difficult. One expert who has seen similar installations says that it is one of the best jobs he ever saw. It is the efficient way in which this work was done that is largely responsible for the perfect working of the apparatus, undoubtedly.

The prime object of the apparatus is to get the correct time from Washington.

# QUESTION BOX

This department is for the sole benefit of the electrical experimenter. Questions will be answered here for the benefit of all, but only matter of sufficient interest will be published. Rules under which questions will be answered:

1. Only three questions can be submitted to be answered.
2. Only one side of sheet to be written on; matter must be typewritten or else written in ink, no penciled matter considered.
3. Sketches, diagrams, etc., must be on separate sheets. Questions addressed to this department cannot be answered by mail.

## RECEIVED RADIO ENERGY.

(273) Ralph L. Kunau, Sabula, Ia., asks several radio questions.

A. 1. We would suggest that nothing smaller than No. 16 B. & S. conductor, either solid or stranded, such as lamp cord, should be used in wiring up a radio receiving set. No. 22 to 24 B. & S. wire is used considerably for tuning coils.

The voltage of a received current on a wireless aerial over medium distances where the signal is strong is of course very minute. It is probably on the order of one hundred-thousandth of a volt. Under ordinary conditions, using a crystal detector with high resistance head phones, etc., the current necessary in the aerial for good, readable signals is about 40 micro-amperes. Signals are rather hard to read when the current drops as low as 10 to 15 micro-amperes. Of course, when amplifiers are used, the current may be many times weaker than here mentioned, and the signals will still be readable. An experimental potentiometer may be made from a pencil as you suggest.

## WAVE LENGTH MEASUREMENT.

(274) Mr. S. H. H——, Cleveland, Tenn., sends several radio wave length queries.

A. 1. In regard to your aerial wave length and your wave meter, etc., would advise that as long as you have a wave meter of the Clapp-Eastham type you should have no trouble in finding out just what adjustments you have in your circuits as to wave length values, etc.

After looking over your question carefully, it appears that either the capacity or the inductance in the closed oscillating circuit must be reduced, if you are to radiate energy at 200 meters wave length. We believe that in your second case that the wave meter has been placed too close entirely to the excited system of the aerial. This, of course, would account for the fact that you could hear the signals in the wave meter receiver all over the condenser scale. In using the wave meter in every case, it must only be placed just close enough to the wireless transmitting set so that the faintest signal can be heard nicely at the point of maximum resonance in the wave meter. This point is found by turning the condenser handle back and forth.

The editor of this column, from some experience in the matter, always prefers when possible, or when tuning transmitter sets, to make use of a small low-voltage battery lamp or a small Geissler tube connected across the condenser terminals of the wave meter as a resonance indicator in place of a telephone and the detector. Undoubtedly, when you get your two oscillating circuits properly joined together or in perfect resonance, you will be able to transmit 80 to 100 miles easily with your 12-inch spark coil and electrolytic interrupter.

## RADIO QUERIES.

(275.) Rudolph Fehnle, Moballa, Ore., asks the question department several radio questions.

A. 1. A double head-phone set is always preferred to a single receiver, as the joint action of two 'phones acting on both ears simultaneously gives a much better effect acoustically than when only one is used.

When tuning coils are used for loading purposes they are simply connected in series with the aerial lead-in, one wire being joined to the end of the coil proper and the other wire to one of the sliders.

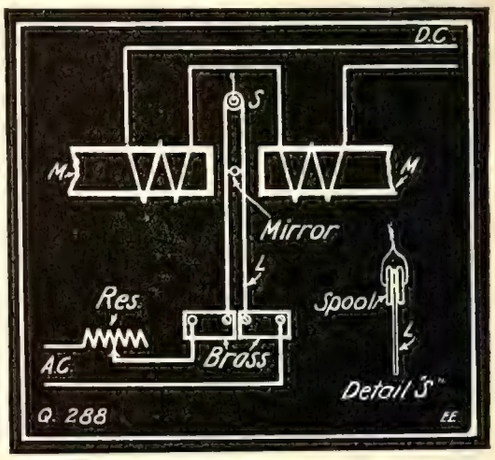
We do not suggest sand-papering enameled wire on tuning coils, except where the slider is to make contact. The capacity effect of enameled wire insulation is of small import, generally speaking.

## OSCILLOGRAPHS.

(275 A.) Oscar P.——, 825 Roscoe street, Chicago, Ill., is interested in the operation of an oscillograph for tracing the curve of alternating wave form, time-circuit values, etc.:

A. 1. The sketch shows simply how the oscillograph works, and the current of which a record is desired is passed through the looped wire shown, which is supported in a powerful magnetic field, produced by direct current excited magnets MM.

The looped wire L can be of fine platinum (say .0005" dia.), and it passes around a small spool-shaped suspension, as sketch shows, the spool being hung on a fine quartz fiber preferably. Between the wires is supported a miniature metallic mirror, which reflects a beam of light on a moving strip of photographic film. After a record has been taken the film is developed as usual. The film compartment is, of course, light-tight and the fluctuating current passing through the loop L causes the moving mirror to trace a line of the wave form, etc., on the moving film. A



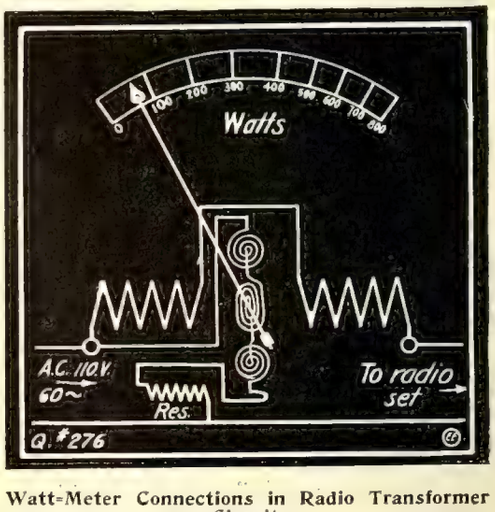

**The Principle of the Oscillograph.**

suitable resistance should be connected in series with the element L, of course.

It is possible to build one of these machines cheaply with a little care, but the commercial machines are rather expensive and generally cost in the neighborhood of several hundred dollars.

## WATTMETER HOOK-UP.

(276.) James W. H.——, New York City, wants connection diagram for Weston type direct-reading wattmeter in a wireless transmitting circuit.




**Watt-Meter Connections in Radio Transformer Circuit.**

A. 1. Diagram is given herewith for connecting a direct-reading wattmeter in on 110-volt A. C. wireless transmitting sets.

## LODGE MERCURY COHERER.

(277.) Sumner B. Young, Dorchester, Mass., inquires as to the construction of the Lodge mercury coherer:

A. 1. In the mercury coherer of Lodge's pattern a toothed wheel is caused to rotate by clockwork, etc., over a small mercury pool. Over the mercury is placed a thin film of oil such as machine oil, and the coherer is so adjusted that the teeth of the brass wheel just barely touch the mercury. The sketch shows the arrangement of this device in this case.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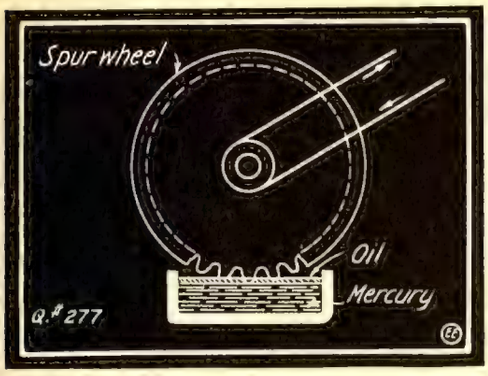


The Lodge Mercury Coherer.

## TOPOGRAPHY VERSUS WIRELESS.

(278.) F. W. Noel, Boswell, Pa., asks us about height above sea level in respect to wireless work:

A. 1. The height of your location above sea level has no appreciable effect on radio operation, generally speaking. What we mean to say is that persons living at very high altitudes and those living in valleys several thousand feet lower use practically the same aerial dimensions. It is considered best, however, when a choice can be had, to erect the aerial on the highest point of land available.

You should be able to get the Arlington Time Signals at your location, 200 miles from Washington, with a good receiving outfit, providing your aerial has a fair length. The length should be preferably from 100 to 150 feet, but you may try your 55-foot length aerial before increasing same if desired.

## TELEPHONE RECEIVER NEEDS REMAGNETIZING.

(279.) Philip C. Platt, Bridgeport, Conn., writes regarding a telephone receiver which has apparently become demagnetized:

A. 1. Most probably you had best return the receiver, which has its magnets weakened, to the makers for remagnetizing.

A. 2. Rotary spark gaps are used a great deal with spark coils, but unless some synchronous form of interrupter or commutator is used in connection with the rotary gap it is very difficult to get a pure tone from the outfit. Quenched spark gaps are generally found best for use with spark coils, no matter whether the coil is interrupted in the primary circuit by a vibrator or electrolytic interrupter. The above consideration will be evident to you very plainly upon analyzing the action of such interrupters, which is very unsteady or variable as to frequency.

## LOOSE-COUPLER SWITCHES.

(280.) William Neckerman, West New York, N. J., wants to know how switches can be connected to loose-coupler primary so as to cut out one of the tap switches where desired:

A. 1. You can divide up the winding as you mention on the large loose coupler and simply place a two-point switch "S," as shown in diagram, to quickly cut out about half the winding or other parts of it in one step as desired for rapid change of

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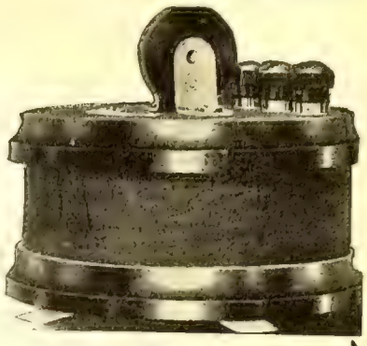

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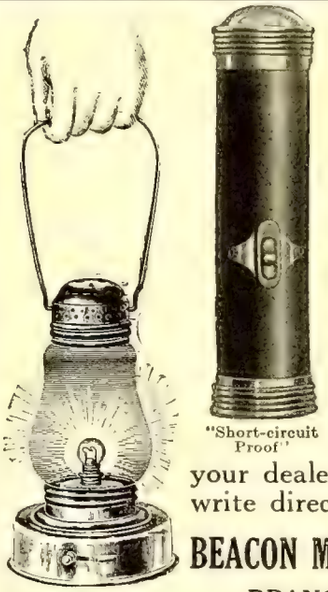

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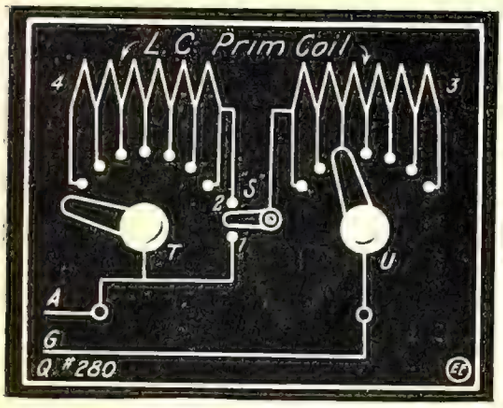
wave length. By the arrangement here shown you also gain a great deal, as when the switch "S" is on point 1, and switch




**Switching Scheme for Loose Coupler.**

"T" is opened or placed on the dead point, there will not be an undue loss from distributed capacity in the idle turns of the coil.

## INDUCTION COILS ON A. C. TRANSFORMERS.

(281.) Frank S. A.— —,Easton, Md., states he cannot get his induction coil working right on a step-down A. C. transformer:

A. 1. We do not know how you are attempting to use your spark coil in connection with the small A. C. transformer of the step-down type.

However, we may state that in every case such as this the spark coil vibrator is, of course, used the same as if a battery were employed. Otherwise you will get no results at all, as the low voltage A. C. has too smooth a sine wave form to give any results in the spark coil, and the vibrator must be used to give a sharp break in the circuit.

The statement you make is incorrect regarding the passage of an alternating current through any coil which has an iron core within it. Any transformer ever used, practically speaking, has, of course, its proper iron core, and alternating current is used in all of these transformers throughout the country for lighting and power work, for wireless stations, etc. The current in the ordinary spark coil, using batteries for excitation, is really an unsymmetrical alternating current, as has been proved by oscillographic tests in the laboratory.

## DICTAGRAPHS FOR DEAF PEOPLE

(282.) E. I. C.——, Lexington, N. Y., writes us regarding a special model dictagraph which he has purchased for helping him to hear better, and which does not help him as expected:

A. 1. The editor of this column has known of a number of such cases and, in fact, has been personally familiar with a couple of cases where such instruments as the dictagraph did not prove of benefit at the first trials of same. This is due probably to the fact that such an instrument gives forth rather a harsh sound in reproducing the speech at first to a person who has never heard it in operation before; therefore speech is not always fully intelligible. We believe, however, if you try this instrument daily for a week or more that you will soon become accustomed to it and that it will help you. Most companies do not, however, make any positive guarantee at all that this instrument will absolutely in every case help those hard of hearing to hear perfectly. This is because every case of deafness or partial deafness

(*Continued on page 73, first column.*)

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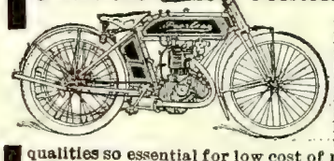

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## CHEAPER ELECTRIC VEHICLES.

A new style of electric vehicle has been developed by a New York engineer, it is said, which will make possible a large reduction in the cost of same. Dr. C. P. Steinmetz said recently of this new design, "that it held great promises. Among other unusual features this electric auto has no differential gear, but a divided motor, in which the field and armature both rotate, each driving one rear wheel. Electric braking is utilized, and arrangement is made to permit the motor acting as generator to partially recharge the storage battery when running down hill. Twice the power ordinarily realized is obtained owing to the field and armature both revolving, thus reducing the size of battery required."

## BARON MÜNCHHAUSEN'S NEW SCIENTIFIC ADVENTURES.

(*Continued from page 43.*)

me, while tears of gratitude ran down his ruddy cheeks. We then discussed the details, and next morning we put the whole plan before the Government. The President and his Cabinet, General Sir John French, of the British army, as well as King Albert, of the Belgian army, were even more enthusiastic than Joffre had been, and a vote was passed immediately authorizing me to go ahead with the work.

"So cautiously did we proceed that no German spy ever got wind of the great scheme. No suspicious character was allowed to come within 10 miles of the tunnel openings and, as the latter were cunningly started under large railroad sheds, reconnoitering aeroplances of the enemy never suspected what was going on beneath.

"There were four large tunnels all told. The first started at a point near Pont-à-Mousson, ending in the forest of La Fourasse. Another one started not far from Verdun and ended in the forest of the Argonne. No blasting or dynamite was used for fear of arousing the Germans overhead; each tunnel was large enough to enable 20 men to march abreast in it upright.

"At the end of December, 1914, we had over 150,000 men at work on the four tunnels, and by February 1, 1915, they were completed except for a few yards at the far end. During that night the entire French as well as British and Belgian armies walked into the tunnels—men, horses, automobiles, artillery and all. We had burned our bridges behind us; everything was staked on the *grand coup*.

"A small opening was then made carefully at the end of each tunnel, and one of our men cautiously emerged through each small hole. Each of the four reported the forests quiet, whereupon our sappers quickly broke out a large opening; within one hour our armies began to *debouche* from the tunnels, and by morning the four units had marched out of the four forests. One-half of the armies were to fall into the backs of the Germans and the other half were to march on Berlin. I was with the latter, highly elated at our success. We immediately seized all railways and roads, and our advance began.

"There was only one thing which disturbed us. By night we were informed that the other half of our legions which were to fall into the back of the enemy had failed to find a single German soldier. Neither Joffre nor I could understand this, but the next morning we had the glad tidings that our army had taken some 40,000 prisoners and that not a single German remained. Joffre and I naturally reasoned

(*Continued on page 73, second column.*)

(*Continued from page 72.*)

is different, and some require surgical or other treatment.

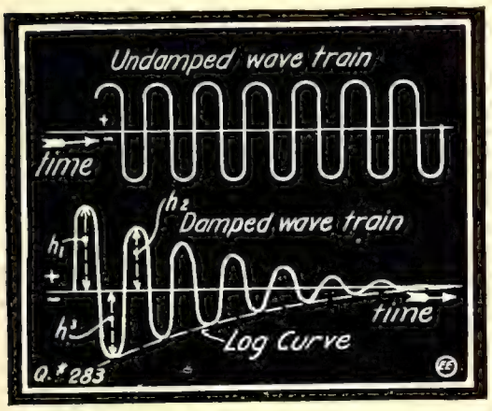
## DAMPED AND UNDAMPED WAVES.

(283.) Blair Mudgett, Johnstown, Pa., asks for explanation of damped and undamped radio wave phenomena:

A. 1. The curves here shown will give you an idea as to what is meant by the damping of radio waves. As you will perceive, these waves gradually but surely fall off to zero amplitude. This considers, of course, a damped or spark wave, and not an undamped wave, such as that developed or produced by an arc generator, for instance.

The damping of the waves as here outlined takes place in accordance with the rule of logarithmic decay—that is, the peaks of various successive waves or positive and negative ripples follow a logarithmic curve as perceived from sketch.

By logarithmic decrement is meant a certain amplitude value of one successive wave as compared with the preceding. The Government radio law now in effect stipu-




**Difference Between Damped and Undamped Wave Trains.**

lates that the ratio between the amplitude of the first wave and the second half wave following it shall not exceed 2-10 when these two amplitude values are compared with a Naperian logarithmic base. In practise this logarithmic decrement is always found with a decrementer such as the Marconi or Kolster type.

The logarithmic decrement in Germany and the United States considers the value of decrement as equal to the Naperian logarithm of the term (height of wave h1 divided by height or amplitude of wave h2). In England the decrement is expressed as Nap. log. of h1 divided by the next half wave amplitude h3. Hence the U. S. value is found by multiplying the English text-book value by 2.

A log. decrement of .2 is equivalent to 12.5 waves in the train before the amplitude "h" falls below one-tenth of the maximum. Good tuning cannot be done if there are less than about 15 waves in the train. Hence the law stipulates a decrement of not more than two-tenths.

## THE SEPARATION OF STEEL AND COPPER FILINGS.

Put some fine copper and steel filings on a piece of paper. By passing an electric spark from an induction coil through them the filings will be found separated. Arrange very fine copper filings on a sheet of paper. It will be found that one electrode only will attract the copper filings, the other electrode remaining inactive. If for copper filings we substitute powdered plumbago on glass we shall find a decided repulsion ensuing.

(*Continued from page 72.*)

that the Germans had held their western trenches largely by bluff, while their real army, consisting of several million soldiers, had been thrown against the Russians to hold the latter back from East Prussia and their new invasion of Hungary.

"We therefore pressed forward with great speed, using Germany's wonderful strategic railroad system for the main advance.

"On February 5 our allied armies had crossed the Rhine at Cologne, Koblenz and Mayence. On February 10 we crossed the Weser, and on February 20 we entered Berlin triumphantly, without a shot having been fired. It was almost too good to be true, but more work lay ahead of us. Our mission was only half filled. We had not as yet conquered the main German and Austrian armies, which we knew to be on the eastern frontier, and no victory can be complete as long as a powerful army remains in the field. In accordance with this, we began pressing forward again, when we were dealt a most terrible shock.

"We received the awful intelligence from our army which we had left behind (in order to patrol the conquered territory) that one and one-half million Germans were rushing on us with forced marches *from France!*

"We were dumfounded. Was it a trick or a hoax?

"Alas, it was neither. I will not bore you to death with a most unfortunate, heart-rending tale. This is what happened:

"Some German had hit upon the same idea as I had, but instead of boring four tunnels they bored but two. That was the only difference! While we thought we emerged behind their backs, they thought they were doing the same thing in reference to us. By a strange coincidence they marched out of their tunnels during the same night as we marched out of ours *and, while we captured Berlin, they captured Paris and then Bordeaux!*

"Not finding our armies (which they thought had retreated into the interior), they feared a trick and rushed back till they came upon the other half of our army stationed along the Rhine. Then they knew the truth.

"A curious state of affairs had, therefore, arisen in this terrible mix-up:

"*We held Germany and a part of Austria, while the Germans held nearly all of France!* Neither of us had gained any advantage, so we called a truce and agreed to trade back our present trenches for our former ones, while they agreed to take back theirs.

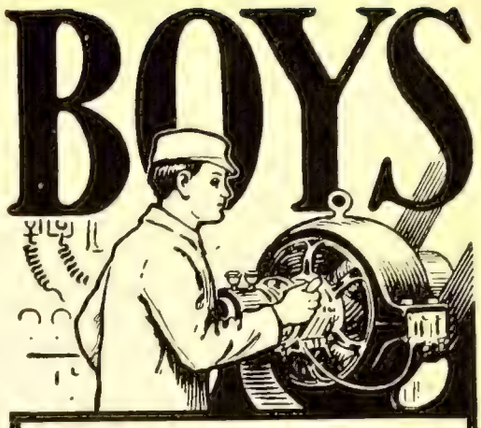
"For this reason March 1, 1915, found us in exactly the same position we had left on February 1, 1915, with the difference that for two days the Kaiser had been in Paris, while Joffre and I had been in Berlin!

"I immediately fell in disgrace with the Allies and I thought it best to take myself out of the way, which I did."

Baron Münchhausen took a long breath at this juncture, so I commented:

"This is certainly a most remarkable story; but, my dear Baron, how is it possible that we have never heard a single word about this momentous phase of the war? No newspaper ever mentioned a word about it, to the best of my knowledge. How can you explain that?"

"My dear boy," Münchhausen replied wearily, "evidently you have not been in Europe during the war. The explanation lies in the one word: Censorship! The Allies while marching on Berlin allowed no news to leave the country for fear that the German and Austrian armies at the Russian frontier would hear about it too early, so they naturally kept quiet."


# Big Money in Electricity

The electrical industries offer wonderful opportunities for boys with a liking for electricity. The salaries paid to trained men are large—promotion comes rapidly, and, best of all, the profession is not overcrowded.

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"But, your Excellency," I broke in, "how could that have helped you? As you advanced from town to town in Germany the Germans certainly must have had plenty of time to send word ahead by telegraph to their armies at the Russian frontier that the Allies were advancing on Berlin. This does not look right, somehow."

Baron Münchhausen chuckled softly for some time before he replied:

"Ah, my boy, I knew you would ask this, so I kept it until the last. The failure of the Germans in the East to receive news of our invasion was entirely due to a brilliant ruse of mine, studied out long before our entry into Germany. Like all my successes, this one was the simplest of them all. Ridiculously simple! I must laugh every time I think of it!

"You see, when the Allies emerged from the forests that night they were all of them, down to the last soldier, *attired in German uniforms!!*

"As large bodies of German soldiers were thrown back and forward over the great German railroad system so often during the war no one thought anything of our invasion, thinking us, of course, as Germans all the while; as a matter of fact, *over 80 per cent. of the German population never knew that the Allies had invaded Germany and Austria until we were back in our own trenches in northern France and Flanders.*"

Here Münchhausen indulged in an uproarious laugh before he proceeded:

"The fortresses which we encountered had so few men that we did not even bother to take them. Had the defenders found out during our advance on Berlin that we were not their compatriots they would have been powerless, as their numbers were pitifully small as compared with the immense armies of the Allies. However, they never suspected us. As we had naturally taken charge of all the telegraph and telephone lines immediately upon emerging from our forests, we sent, of course, fake war reports to Berlin all day long purporting to come from the front. The deception could not have been more complete. So you can readily see that all the 'news' which the Nauen wireless plant sent out broadcast each day over the entire world during the month of March was nothing but a hoax, manufactured expressly for it by our own General Staff!"

I was so stunned by this revelation that I sat speechless for a few seconds. But I collected my thoughts suddenly, and demanded:

"That is all good and well as far as it goes, but what about the German army in France, my dear Baron? How could over a million Germans have taken Paris and Bordeaux without the outside world hearing about it?"

I thought surely that I had cornered Münchhausen that time, but he merely gave a deep sigh and said sadly:

"Alas, great minds always run in the same channels. That German who thought of digging the tunnels underneath our troops also thought of putting *his* soldiers *into French and British uniforms!!*

"So, you see, the German masqueraded armies fooled the French population precisely in the same manner as I fooled the German people with mine. There are thousands of French even to-day who have not the slightest knowledge that Paris or Bordeaux had been actually in German hands!! Think it over, and you can reason it out yourself how it worked. . ."

"And what did you do next, your Excellency?" I asked, more or less apologetically, for having doubted the Great Man's word.

"My last experience with the Allies having proved so humiliating to me, I did not wish to show my face in Europe any longer,


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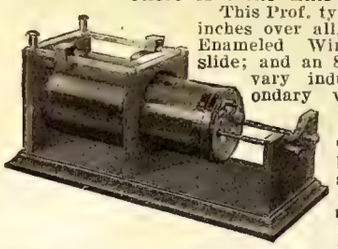

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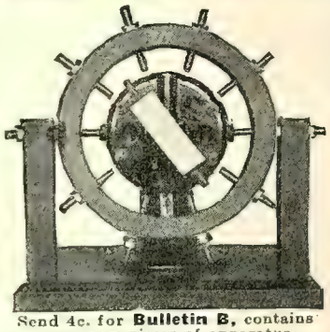

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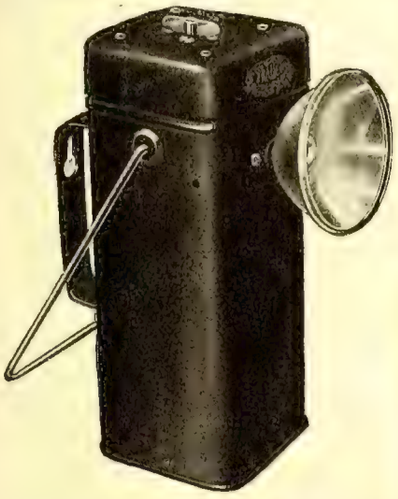

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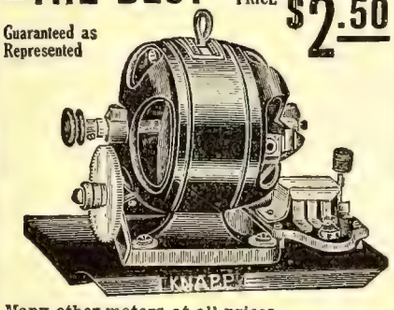

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so I decided to come to America, where I arrived in the middle of March. Having been in America previously, the country was not new to me; as a matter of fact, I had acquired some years before a large estate on the south shore of Long Island. To this I retired and, not having many friends in the neighborhood, no one bothered me much and I shortly completed my inventions on which I had been experimenting in Paris and which the war brought to an abrupt termination, as mentioned to you before.

"The problems of gravity had long attracted me most powerfully. With Newton, the famous, I wondered what made an apple fall from a tree or a brick from a roof. Newton long ago, in his famous works, had told us the *why*, but he had died without knowing the *how*. He knew all the laws governing gravity, but he knew not what the force consisted of. He was very much like Edison, who knows a great deal about electricity and its laws, but who does not know what electricity itself consists of.

"It did not take me a long time to actually solve the mysteries of gravity, once I hit upon the right track. I found that gravity, like electricity, is a certain manifestation of the luminiferous ether which permeates the universe and all matter.

"Once I had solved the mystery I set out immediately to find an insulator for gravity, and in a few days I had solved this problem in a masterful manner.

"To make myself plain: On earth all objects are attracted to the center of the earth by the force known as gravity. Whether it be a cannon ball or a feather, both will fall on the earth's surface if unsupported. If some means could be found to interpose between a falling apple and the earth a 'gravity' insulator, through which gravity could not act, the apple would stay suspended in mid-air, theoretically. It could not fall to the earth because there would be no longer any gravity to attract it.

"A parallel to the above is found in the following simple experiment: Take a steel ball and rest it on a smooth surface. Then take a strong horseshoe magnet. With it approach the steel ball; as soon as the magnet comes close enough the ball will roll toward the magnet till it reaches it. Separate the two again and repeat the performance, but before the ball reaches the magnet interpose a magnetic 'insulator' between ball and magnet—in this instance a stout piece of sheet iron. The iron will take up all the magnetism and no magnetic flux will reach the ball. Consequently it will lay still, unaffected by the strong magnet, which is just as strong as ever, but 'neutralized' by the piece of sheet iron.

"To go further: Before any form of energy can be transmitted from one point to the other it *must* pass through a conducting medium. Take the medium away and the energy cannot be transmitted any longer. To illustrate:

"Take sound, for example—a simple form of energy. A bell rings. The sound waves generated from the bell's gong travel through the air till they strike your ear drum. You hear the bell. In this case the air is the conveying medium. Take the air away and you can no longer hear the bell. Thus when a bell is placed under a glass globe you can still hear the bell. With an air pump now extract the air from the globe; you can still see the clapper of the bell strike the gong furiously, but you cannot hear a single sound, because you have taken away the conducting medium, the air.

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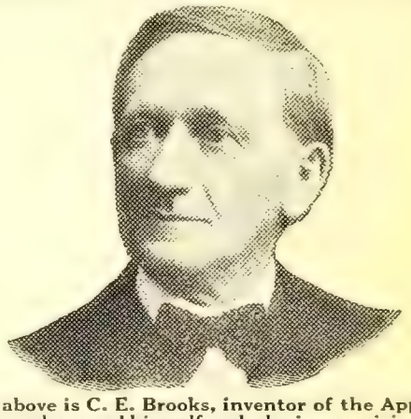

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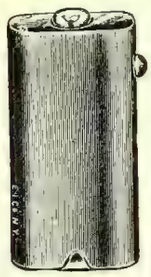

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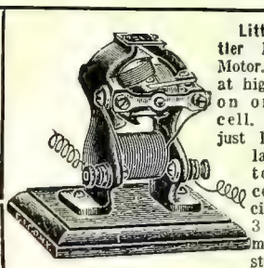

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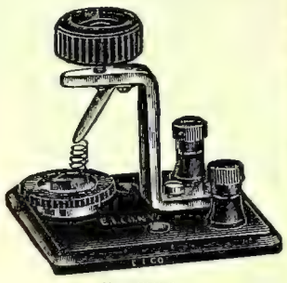

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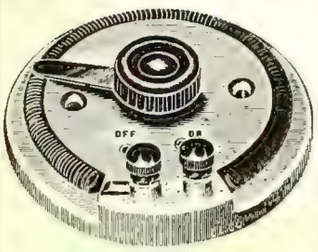

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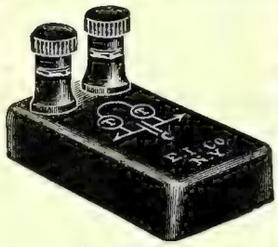

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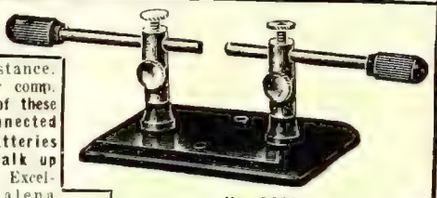

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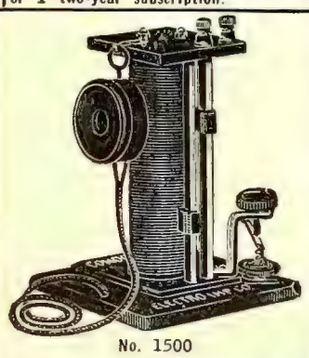

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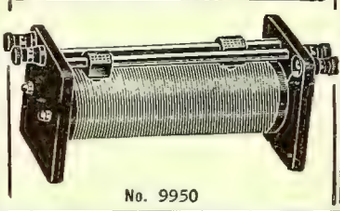

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## The Electrical Experimenter

**Premium Dept. 233 Fulton Street New York City**


planets. What is the necessary conducting medium here? The luminiferous ether, that mysterious fluid, so fine, so intangible that man has as yet never seen, nor felt, nor weighed it. Nevertheless, we have long known of its existence. It fills the pores of the densest metal as well as all space in the universe. There is no atom on earth or in the heavens which it does not permeate completely at all times.

"But of course this is all well known to you. I simply recite it so that the following may become plain to you:

"I take a glass tube five feet long, in which I place a piece of cork. Then I exhaust all the air from the tube. When I turn the tube upside down the cork will, of course, fall from the top of the tube to the bottom. Through what medium does the energy of gravity pass to reach the cork and force it to fall down? The ether. I now take my gravity insulator, place it between the tube and the earth and turn the tube upside down. What happens? The cork no longer falls down, but stays on top; furthermore, the entire tube, cork and all, 'floats' in the air when my hand releases it. Gravitational force cannot reach the tube. It is 'insulated,' the same as glass insulates electricity and prevents it from leaving its conducting wire.

"My gravity insulator is simply a curiously arranged wire netting of insulated *Marconium* wires crossing each other at right angles. Marconium is a certain metal of the rubidium group discovered by me; a netting of this wire, when excited with a powerful current of a peculiar wave and a frequency running into the millions, acts as a perfect insulator toward gravity BECAUSE IT NEUTRALIZES THE ETHER ABOVE AND BELOW IT. When placed above the ground you can pile tons of metal or stone or any other material over it. It will not touch the gravity insulator unless you push it down on it by applying an external force to it. The material cannot drop on the insulator by its own weight because NOTHING HAS WEIGHT IN SPACE, WHERE THERE IS NO GRAVITY.

"To prove this axiom I placed a spring scale over my gravity insulator. The scale stayed, of course, suspended as soon as I took my hands away from it. Now I placed weights on top of the scale, starting with a one-pound weight. The scale registered no weight, even when I increased the weight to 100 pounds. Under normal conditions my weights would have tipped the scales to 100 pounds. On top of the 'insulator' the 'weight' had vanished, the same as the sound of your bell will vanish, when you place it in a vacuum. In order that you will not draw any wrong conclusions, let me state explicitly that the *etherless zone is confined only to about one inch above and below the Marconium wire netting.* Thus any object placed above the 'insulator' is, of course, surrounded by ether *else you could not see it.* But gravity on earth (unlike ether) acts only in a straight line, this line passing through the center of the earth.

"For this reason objects placed above my 'insulator' will only stay suspended if placed directly above it. If a part of the object extends over the edge of the netting the object will fall down on the netting, because gravity will pull down on the 'exposed' part of the object. In order to carry out these experiments successfully it is quite necessary that the sun, as well as the moon, are quite below the earth's horizon. If this precaution is not taken the object above the 'insulator' will be attracted immediately toward the sun or toward the moon unless another gravity insulator is placed *above* the object to neutralize the sun's or the moon's gravitational attraction.

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We furnish blue prints, finishing material and instructions. Buy the works, dial, weights and pendulum from us at surprisingly low prices. You make a fine profit building artistic clocks for your friends. Complete works, $5.00. Others with chimes at all prices. Ask for attractive free offer.

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Standard and Special Shapes, Regardless of How Difficult

We illustrate one hard shape we make. A pair of rolls 7½" long and 1¼" in diameter with 8 holes on ends and middle. They must be perfectly straight and we make them so. It's hard but not for us. We can make your difficult designs also. Send us blue print for quotations.

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Tells how to *help save money* and make work *easy for you.* Just the thing for all Mechanics, Electricians, Plumbers, Steamfitters, Carpenters, Contractors, etc. *Write today* for this FREE handbook and *state your occupation.*

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Send 50c. in stamps or cash for 5 Bottles of Minerals, assorted in a neat carton—Galena, Silicon, Carborundum, Pyrite and Bornite. The finest detector mineral outfit ever offered. Complete, 5 bottles and box **50c**
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WATCH FOB. Exactly like illustration. The latest fob out. Has bewitching little figure of Miss "September Morn" handsomely embossed on heavy metal plate. Beautiful oxidized silver finish. Size of medal 1¼ x 1¾. Genuine black leather strap. Boys, a real work of art. Classy, alluring. **Makes 'em all take notice.** Agents wanted everywhere. Dandy sample fob and our great easy money proposition to hustlers sent **Postpaid 25 cents.**
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707 Lewis Block Buffalo, N. Y.

"My invention completed, I immediately set to work toward building a machine which would enable me to leave the earth. I accordingly constructed a very strong steel globe about 60 feet in diameter, which was to take me out into space, my first planned excursion having for its object our nearest neighbor in space, the moon, only 240,000 miles distant.

"The steel globe which was to take me to the moon has its entire outer surface covered with a double Marconium netting, the free, insulated wire ends of the netting entering the globe, where they are connected to an elaborate switching arrangement.

"Running around the globe's circumference—its 'equator'—a wide belt or track is provided. This is the 'landing' track; on it the globe can readily roll over the ground without damaging the Marconium wires underneath. This track is also made of Marconium and is carefully insulated from the rest of the globe. The interior of the globe is well furnished for all comforts and has a powerful electric plant, similar in many respects to a modern submarine power plant.

"After having completed all arrangements, having stocked the machine with all kinds of provisions, fuel and many scientific instruments and apparatus, I made ready to leave old Mother Earth. The trip proving to be extra hazardous, I took only one person along, an intimate friend of mine, Professor Hezekiah Flitternix, of Columbia University.

"The only other animate passengers of the expedition were Buster, my fox terrier, and Pee-Pix, the Professor's canary bird, which he refused to leave behind.

"The moon being full and almost overhead, we entered my machine, which I had christened the evening before as *'The Interstellar.'* The heavy, soft, rubber-lined steel doors having been screwed up airtight, in order that our air should not be drawn out once we were in the open space, I started the generating apparatus. I switched on the Marconium wires which covered the outer surface of the *'Interstellar,' but only that section which was turned toward the earth.* The other half of the netting turned toward the moon was not switched on.

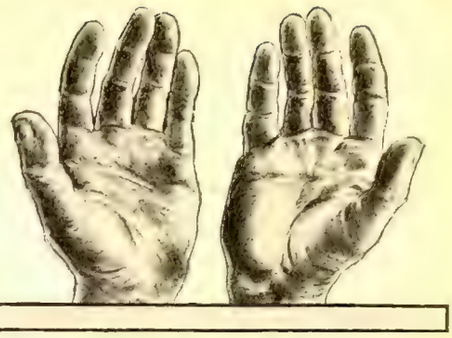
"Through the glass portholes at the bottom of the machine we could see the Marconium wires glowing in their characteristic green glow. Immediately we were lifted toward the moon overhead at a frightful speed. In less than 90 seconds the entire American continent became visible, and in a few more seconds the earth in its true form as an immense globe stood out against a pitch-black sky.

"As light cannot pass through an excited Marconium netting, it was necessary to switch off the current for a few seconds, every time we wished to see earth beneath us.

"The upper part of our machine (turned toward the moon) was now subjected to the moon's gravitational attraction—the earth, on account of the machine's other half being gravity-insulated, no longer attracting it. We were, therefore, 'falling' toward the moon at a constantly increasing speed and—"

At this juncture I heard Münchhausen curse roundly and his voice became indistinct. I barely made out the words: "Power low—tomorrow, 11 P. M.——" then the peculiar screaming sound in my phones, running down the scale; the low click, then everything quiet. . . . . .

The next story is entitled
**"Münchhausen on the Moon."**



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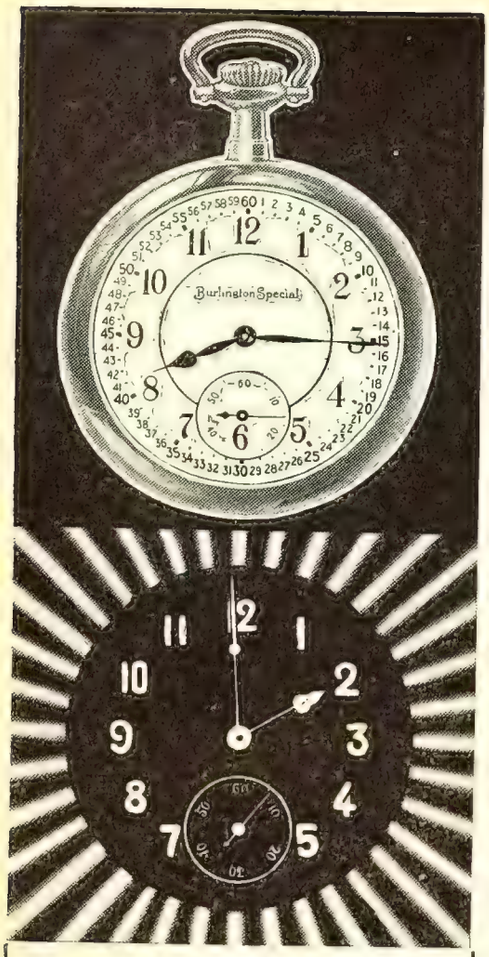

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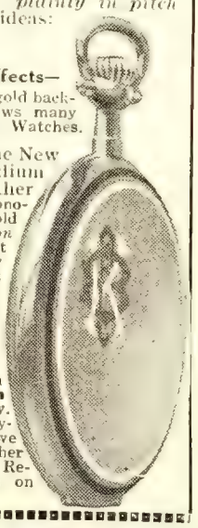

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## POLYTECHNIC ELECTRICAL ENGINEERING SOCIETY.

The Electrical Engineering Society of the Polytechnic Institute of Brooklyn held its annual affair on April 23 at the institute building. Dr. Clayton H. Sharp, of the Electrical Testing Laboratories of New York, gave an interesting lecture on "The Effects of Color and the Modern Development of Electric Illumination."

Illumination by electricity was first introduced by Thomas A. Edison in 1880. His lamp filament was made from charred bamboo strips, known to the trade as carbon filament. The glowing filament produced a yellow light. The efficiency of this lamp was about seven watts per candle. The efficiency of the original Edison filament has been increased to four watts per candle. From 1880 to the present time a variety of filaments have appeared in the illumination field, such as squirted cellulose, 3.1 watts per candle; metallized carbon, 2.5 watts per candle; tantalum, 2 watts per candle; squirted tungsten, 1.25 to 1.5 watts per candle; drawn tungsten, 1 watt per candle, and drawn tungsten in a nitrogen-filled atmosphere, consuming .5 to .8 watts per candle. Dr. Sharp then showed five booths, each containing the colors of the spectrum in cloth fixed in a slanting position from the top and a piece of brown plaid cloth in back of the booths. The first booth was illuminated by a four-watt-per-candle Edison carbon filament lamp and the last booth was illuminated by a .5 to .8 watt drawn tungsten filament in a nitrogen-filled atmosphere. The blue cloth varied in color from a pale blue in the first booth to a dark blue in the last booth, while the plaid changed from a bright red in the first booth to a dark brown in the last booth.

After Dr. Sharp's interesting lecture everybody adjourned to the gymnasium for the dancing.

## RADIO CLUB OF AMERICA MEETING.

The Radio Club of America, one of the latest and rapidly growing wireless societies, held its May meeting at Columbia University on the first of the month.

The evening was taken up with the reading and discussion of two excellent papers by Mr. Paul F. Godley. The titles of the papers were "The Measurement of Intensity of Received Radio Signals" and "Radio Activities on the Pacific Coast."

Mr. L. G. Pacent presided as chairman, and Mr. P. Johnston, secretary of the club, also had a few words to say. The discussion was opened by Mr. Harry Sadenwater, radio inspector for the port of New York, and several other members present contributed to the discussion. Among prominent members present were: Mr. Fritz Lowenstein, consulting radio engineer; Mr. Alfred P. Morgan and Mr. Walter Lemon.

A complete audion receiving set with several bulbs for producing beats was demonstrated and signals from San Francisco were heard plainly. Stations up to 800 miles and more away were heard by means of the audion amplifier and horn all over the lecture room.

The General Electric Co. is building a high frequency wireless alternator to yield 50-75 kilowatts at 50,000 cycles. These are to be compared with the 75-100 K. W. Poulsen arcs now in use for long-distance radio work.

Avoid touching radio detector crystals with the fingers, as oil from the skin adheres to the crystal, thereby reducing its sensitiveness.


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Large Illustrated Catalogue of
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# Opportunity Exchange

YOU will probably find more opportunities and real bargains in these columns than anywhere else in the country. Most good things in life are hard to find and worth going after—these little ads illustrate that point; you alone will be the real loser if you don't take the time to scan through these columns.

Advertisements in this section 4c. a word for each insertion. Count 7 words per line.

Name and address must be included at the above rate. Cash should accompany all classified advertisements unless placed by an accredited advertising agency.

Ten per cent. discount for 6 issues, 20 per cent. discount for 12 issues from above rate. Objectionable or misleading advertisements not accepted.

Advertisements for the July issue should reach us not later than June 10th.

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"TRAFFIC in Souls." This book is based upon the most widely discussed motion picture production. It is a powerful study of vice conditions in New York, and the facts upon which it is based were compiled from the Rockefeller White Slave Report. Illustrated with striking photographs. 300 pages. Send prepaid for 60c. Hesse Mercantile Co., 12 East 22d St., New York.

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PIGEONS—The finest Pigeon Magazine, $1.00 a year, or send 25c. for four months' trial. Pigeons Magazine, 948 Advertising Bldg., Chicago.

MODERN Dances—Best Instruction Book for beginners. 17 dances fully illustrated. 25c. prepaid. Danse Publishing Co., 500 Fifth Ave., New York.

HAVE YOU SEEN A COPY?—Amateur Photographer's Weekly, $1 per year; weekly prize competitions; criticisms; print exchange; illustrated; many features. Three months' subscription 25c. Amateur Photographer's Weekly, 915 Schofield Bldg., Cleveland, Ohio.

ENGINEERS' questions and answers for license by Hobson for 25c. postpaid. Send stamps. Reilly's Book Store, Dept. E., Philadelphia, Pa.

PERSONAL—War Pictures and Catalogue. 10c. Paul Cornish, Schenectady, N. Y.

## BICYCLES AND MOTORCYCLES

CLOSING Out Sale high-grade slightly used motorcycles. We have about 50 left to sell, in standard makes which we are offering at big bargains, such as twin and single-cylinder Indians, Yales, Harley-Davidsons, Merkels, Thors, Excelsiors, Popes, 4-cylinder Hendersons and Pierces. These motorcycles we want to close out this year. No reasonable offer will be refused. Write to-day for our list giving description and prices. Gotham Sporting Goods Co., 57 Warren St., New York City.

FOR Sale cheap. 1914 Harley-Davidson twin. Write for particulars. Walter Goerke, 321 Washington St., Newark, N. J.

1908 H. D. SINGLE with clutch and magneto, $30. 1910 H. D. battery model. A-1 condition, $35. 1911 H. D. single magneto model and clutch, $40. 1910 H. D. clutch and magneto, $45. 1 Indian motorcycle motor with magneto and Schebler carburetor, $25. 1 Excelsior motorcycle motor, $25. C. H. Lang, 1704 Michigan Ave., Chicago, Ill.

$50 TO $150 buys the best Motorcycles, every make and model in our large stock—must be cleared. Half price. Send for list to-day. Talking Machines, $5 and up. Brown Music Co., 9119 Commercial Ave., Chicago, Ill.

SEND for latest Bulletin of real Motorcycle Bargains, used and slightly used, all makes, models and prices; if you have $25 and really want a powerful Motorcycle, send for this Bulletin; hundreds of machines at all prices, new ones on easy payments; tell us what you want and how much you can pay; we can fix you up. Peerless Motorcycle Co., Dorchester, Mass.

USED Motorcycles, all makes, bargains. Send for list. Ward Bros., 212 Broadway, Camden, N. J.

OUR folder showing the new '15 Eagle 2-speed models is ready for mailing. Write for this and for the agency to-day. Sterling Motor Co., Brockton, Mass.

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5-HORSE Pierce, single cylinder, magneto, Schebler carburetor, new tires, perfect running order, $125.00. Fred Gile, 50 Forest Ave., Portland, Maine.

GET copy of "Motor Cycle" published in England. Special War Issues received here weekly. Price 15c. Two for 25c. Distributors, 143 So. Wabasha, St. Paul, Minn.

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IS the formula you want worth a quarter? State exact requirements. Raymond, Roosevelt, N. Y.

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START factory making candies, gums, crackerjack, orangeade, ciders, etc. Sells fast. Nearly all profit. $15 course $1.00. Catalog, 2c. Robert Hamilton, Barnes City, La.

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FORMULAS for inks, black, blue, red, gold, green, silver, indelible, 15c each. 7 for $1.00. Stephen Rafferty, 2122 Arch St., Philadelphia, Pa.

CUTS anybody can make, 5c. Samples Stamp. Modern Engraving Co., Lynn, Mass.

AGENTS—Build a business of your own with our Piano and Furniture Polish. Have used it in our shop successfully for five years. Send $1.00 for formula and trade secret. E. E. Lundberg School Piano Tuning, 143 N. Dearborn St., Chicago.

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$54 CENTURY Grand, bargain, $25. Magnificent Ensign Reflex, Zeiss Triotar Anastigmat, complete, $65. $22.50 Autographic Kodaks, $19.75. Slipin Calender Mounts, assortment, $1. Catalogues mailed. Newark Photo Supply Co., Newark, New Jersey.

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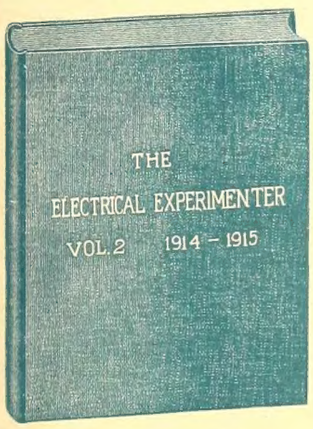


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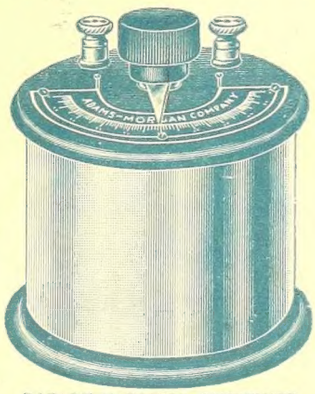


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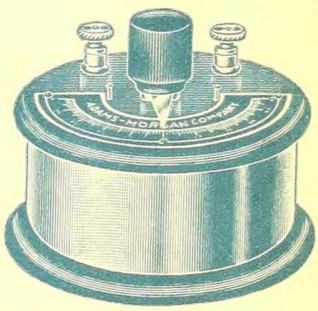


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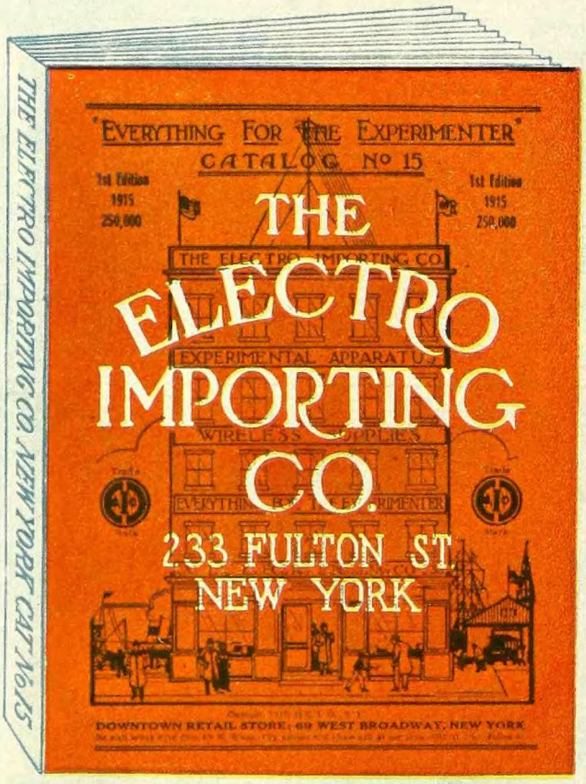
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